THE FOUNDRY

Volume 51
Number 6

Published
Semimonthly

CLEVELAND, OHIO, MARCH 15, 1923

Aluminum Sweeper Castings

Standardized Methods and Processes together with Accurate Molding Equipment and Close Supervision Are Responsible for Successful Product Uniform in Weight and Dimensions

BY PAT DWYER

ANY person who lets his mind dwell for a moment on the subject cannot fail to note the remarkable manner in which man's ingenuity adapts itself to meet changing conditions. The tendency always is to find an easier and faster method for doing a certain task or accomplishing a given piece of work. More and more the great natural forces are brought under control. Steam, air, water and electric current are harnessed to new devices to the end that the individual's efforts are magnified sometimes a thousand fold. Occasionally a device or piece of equipment anticipates the apparent need; but usually the opposite is true. Lack of facilities to cope with actual conditions usually results in the introduction of either an entirely new method of handling the situation or in the application of an improved device that will do a great deal more work in a given time.

So many factors are involved in some problems that centuries elapsed after they first are propounded before they are developed to a point of practical

FIG. 1—METAL IS MELTED IN A BATTERY OF SEVEN 300-POUND FURNACES

FIG. 2—SNAP FLASK FLOORS

application. This notably is true of the steam engine and the electric motor, two prime movers of today.

In the foregoing instances development was delayed principally on account of lack of suitable mechanical equipment and too much credit cannot be given the artificers of a little over a hundred years ago who constructed the first machine tools and the first steam engines. They solved an apparently impossible problem. To have the tools, they needed the engine to furnish power and to construct the engine, they needed the tools. The original starving optimist who stated that if he had some ham he could fry some ham and eggs—if he had the eggs—probably was a lineal descendant of the first engine builder.

So long as carpets and rugs were woven by hand their cost was prohibitive except to a comparatively small number of people, the output naturally was limited and the problem of cleaning them periodically was solved by each individual owner in a manner that suited his own conditions. Eventually power driven machinery increased the output and lowered the cost of floor coverings to a point that rendered it feasible to place a carpet of some kind in practically every home in the land. Then the question of keeping them clean resolved itself into a problem worthy of consideration. Various more or less ingenious devices were employed with indifferent success until M. R. Bissell in 1876 introduced what later became the universal model of a brush sweeper. In later years development of the small

FIG. 4—PART OF THE IMMENSE STOCK OF ALUMINUM CONSTANTLY KEPT ON HAND

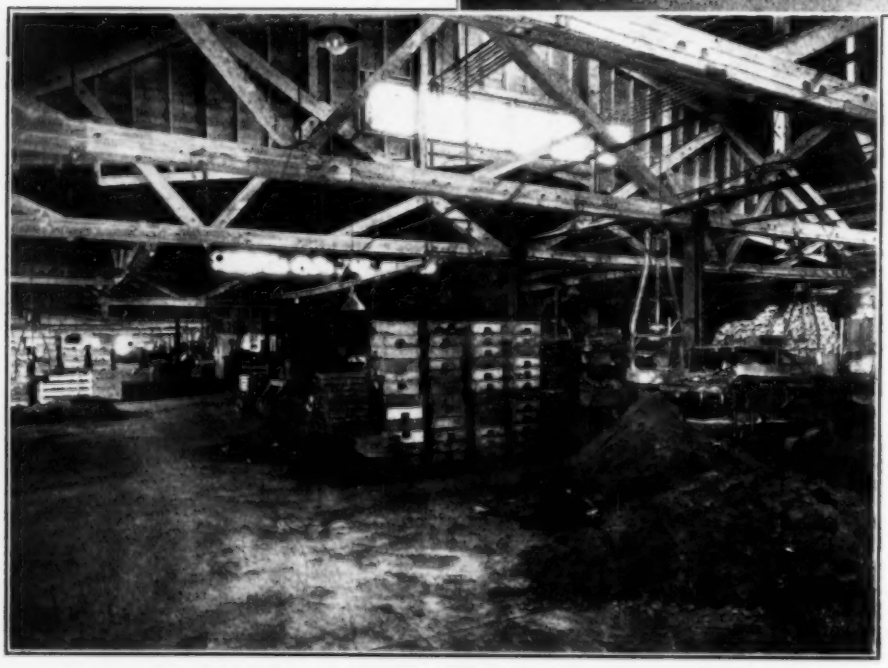


FIG. 3—GYRATORY RIDDLES ARE SUSPENDED AT CONVENIENT POINTS

electric motor led several manufacturers to investigate its possibilities in connection with a suction fan for the same purpose.

A considerable amount of experimental work was required before the vacuum cleaner as we are familiar with it today, was perfected and one of the most important factors in making it a success was the fact that aluminum metal was available for the working parts. Not only was this new metal available, but also foundrymen were familiar with its characteristics and capable of handling it intelligently. One of the largest manufacturers of vacuum cleaners is the Hoover Suction Sweeper Co., with main office and plant at North Canton, O., and subsidiary plants and offices in Canton, Chicago and Hamilton, Ont. This company at its North Canton plant

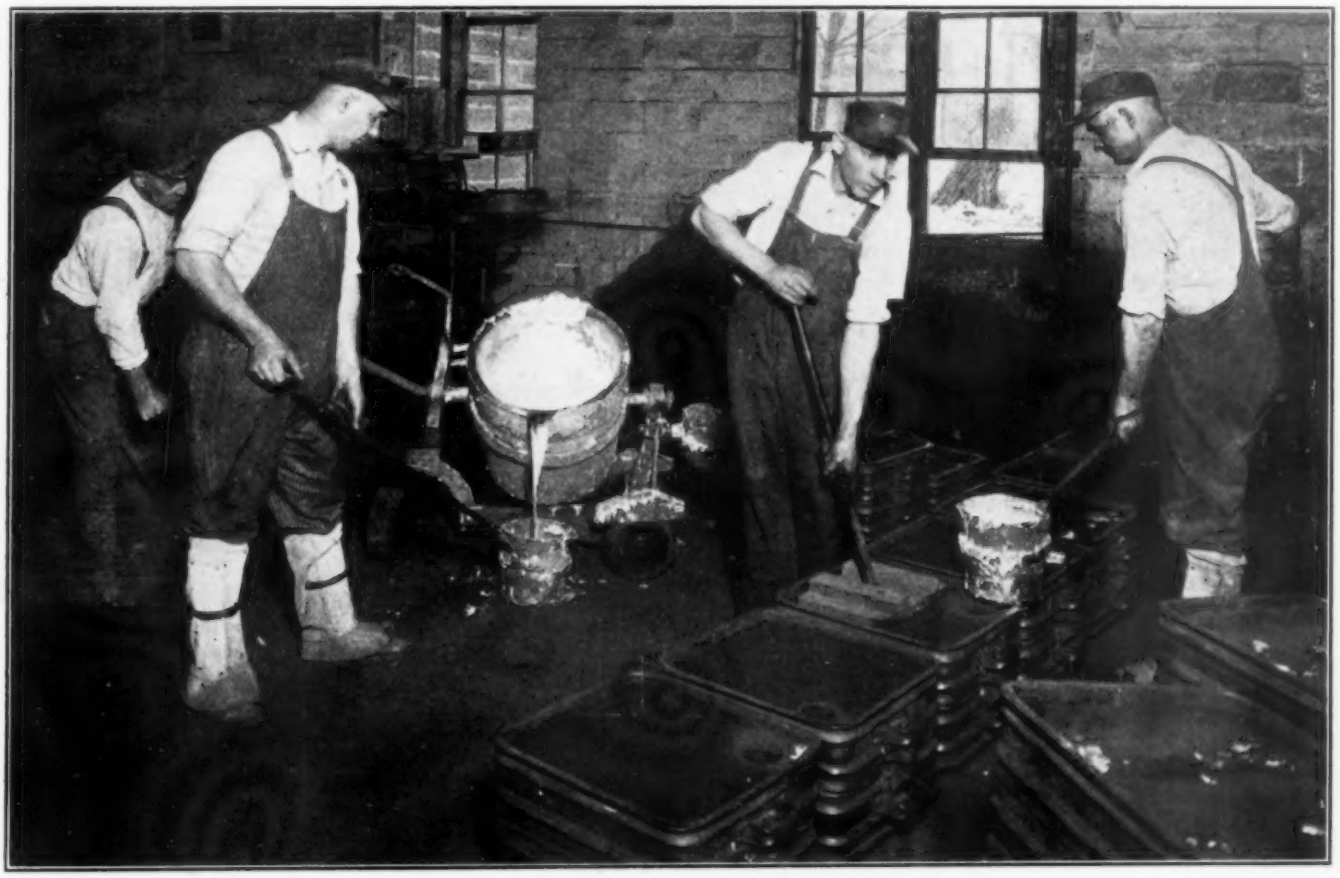


FIG. 5—TWO MEN POUR EACH MOLD FROM TWO HAND LADLES WHILE AN ASSISTANT PRESSES DOWN ON THE COPE WITH A BOARD IN LIEU OF A WEIGHT OR CLAMPS

has a daily capacity of 2500 finished sweepers, but since this article is concerned solely with the foundry department of the plant it is more to the point to indicate that over 2,500,000 pounds of aluminum were melted last year.

Foundry operations are carried on in a one-story building approximately 80 x 500 feet. The walls are formed of concrete blocks, the smooth level floor is surfaced with concrete and the roof is supported on wooden beams. Light is supplied through windows along both sides and a monitor roof extending from end to end along the center and furnishes ample ventilation, also. Steam radiators distributed along both sides close to the walls furnish sufficient heat in conjunction with that given off by the furnaces to maintain a comfortable temperature in the shop in cold weather. In addition, pouring is going on continuously and although the castings are dumped before they have heated the sand to any great extent, still the general effect is to keep the sand at all times at a comfortable temperature.

The sequence of operation is arranged and scheduled so that the raw material is received at one end of the shop, is carried through and is discharged as a finished product at the other end. Thus the sand is stored under cover at one end of the building. Four grades are

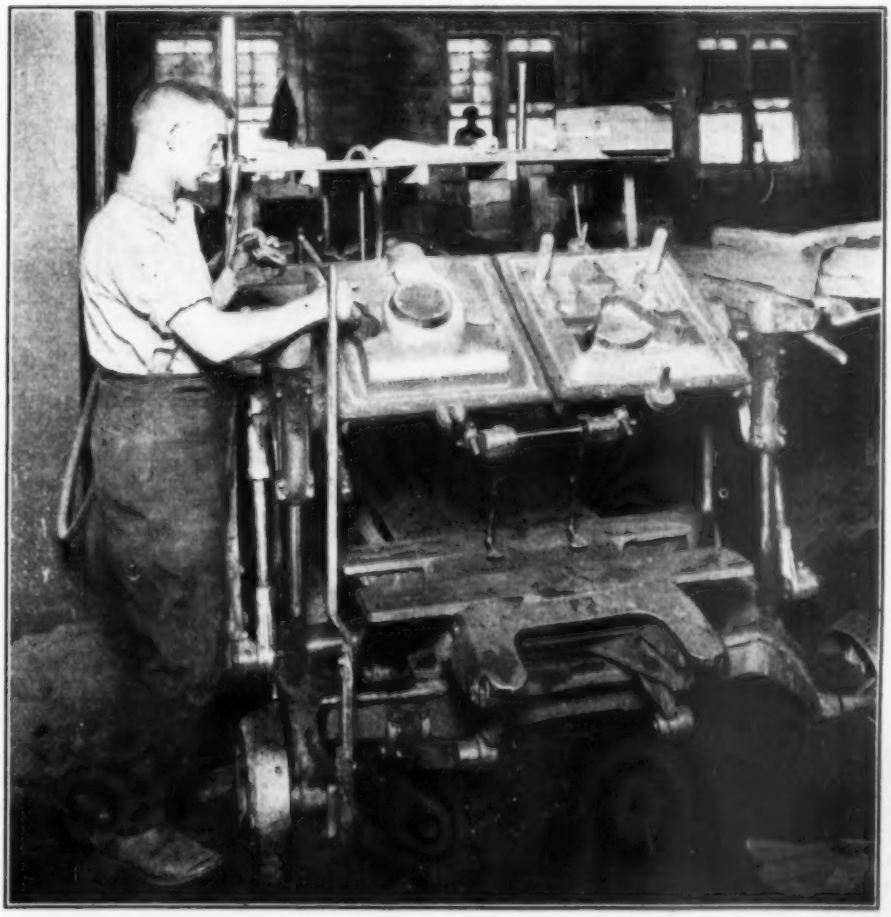


FIG. 6—TWO PATTERNS ARE MOUNTED SIDE BY SIDE AND COPE AND DRAG OF THE MOLD ARE MADE SIMULTANEOUSLY

stocked according to the coarseness. This serves for making the molds and—when combined with varying amounts of sharp sand—also is used for the cores. This arrangement only refers to the larger cores. Small cores, particularly long cylindrical cores, are made from sharp sand bonded with oil.

A large stock of new metal, part of which is shown in Fig. 4 is kept inside a wire enclosure near the same end of the building in which the sand is stored. A scale is provided close at hand and the metal is conveyed to the different furnaces on the small hand truck shown in the center of the same illustration.

Six stationary furnaces set nearly level with the floor and equipped to burn either gas or oil, are located close to and almost opposite the metal storage. They are used for melting special alloys, hardeners and dross and skimmings that accumulate while melting the metal in the regular furnaces designed for the castings.

New Metal Used

With the exception of a little foundry scrap, new metal exclusively is employed for pouring the castings that go to make up the sweepers. Borings, turnings, etc., from the machine shop are passed through a special device where live steam thoroughly extracts all the oil and grease. The borings then are collected, packed in bags and sold to outside interests. None of this material is used in the company's product. On account of the peculiar shape of some of the castings, particularly the large chamber casting known as the drum, it is essential that the metal conform to close specifications and also that all the factors connected with the melting and pouring shall be under close control.

Melt in Tilting Furnaces

Standard No. 12 aluminum for the castings is melted in a battery of seven tilting furnaces. This type of furnace is equipped to burn oil and is provided with a brick baffle under the pot which helps to distribute the flame and thus prevents it from impinging too strongly on one part of the pot's surface.

The manner in which the pot is held in place and prevented from moving while the furnace is tilted back and forth may be observed by examining the nearest pot in the battery shown in Fig. 1. A flat steel strap, bent in the form of a loop is bolted to the top plate of the furnace on each side. The arch of the loop is a little higher than the flange of the pot. After the pot is in place a steel wedge is driven under the loop and over the flange and in that manner the pot is locked firmly in place. The pot has a capacity of 300 pounds, will melt 3000 pounds per day and is good for an average of 80 heats.

Melting pots supplied by local gray iron foundries have been made according to many different analyses at various times and it has been found that those made entirely from car wheel scrap give the best service. The pots employed in this shop are provided with an accessory feature which, it is claimed, has reduced the amount of fuel and the time required to raise the contents of the pot to the desired temperature. Four cleats 1-inch wide, ½-inch thick, spaced equidistantly on the under side of the flange, provide an open space between the flange of the pot and the top plate of the furnace. This opening serves as a vent and draws a keener and more intense flame up around the pot than is the case in those installations where the pot engages the top of the furnace closely.

The sand mixing machinery and equipment, located at the cleaning end of [illegible] was designed by the Hoover Co. and built by the Link-Belt Co., Chicago. The core sand mixer placed nearby was supplied by the Standard Sand & Machine Co., Cleveland. Each of these installations presents several interesting features that will be touched upon later.

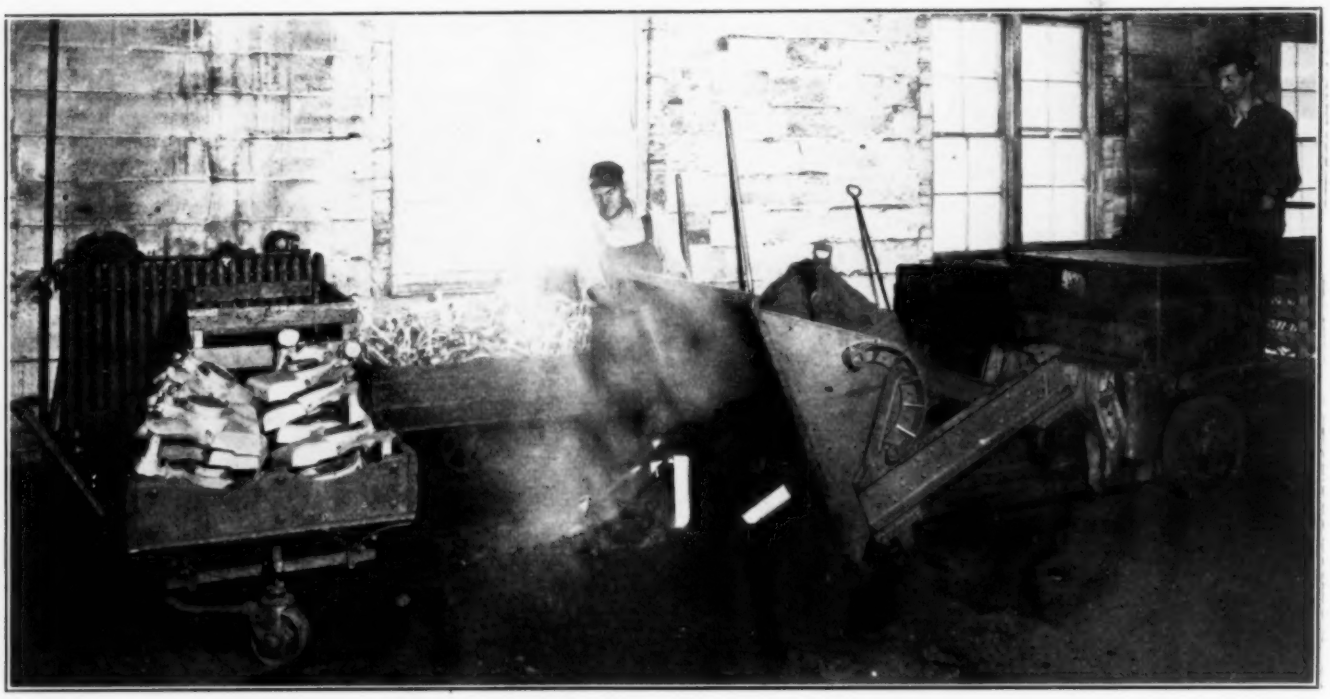


FIG. 7—THE SAND AND CASTINGS ARE TAKEN FROM THE MOLDING FLOOR AND DUMPED OVER A GRATE IN THE FLOOR —THE SAND FALLS THROUGH THE GRATING ON TO A BELT WHICH CONVEYS IT TO THE MIXER— THE CASTINGS ARE RETRIEVED AND TAKEN TO THE CLEANING ROOM

Machines Along Side Wall

A row of molding machines is arranged along each side wall as shown in Fig. 2. The list includes four made by the Osborn Mfg. Co., Cleveland; 27 supplied by a company formerly known as the United States Molding Machine Co., but whose machines now are made by the Johnson & Jennings Co., Cleveland; and 67 made by the Arcade Mfg. Co., Freeport, Ill. In the vicinity of the sand mixing equipment and at one or two other points where the floor space is devoted to other purposes, the machines are located in the most advantageous positions possible under the

FIG. 8—SHOWING DETAIL OF PARTING AND STYLE OF GATING ADOPTED—IT WILL BE NOTED THAT THE FINISHED FACE OF THE CASTING IS MOLDED IN THE DRAG

circumstances. This feature is shown in Fig. 3.

As pouring is carried on continuously all day, it is not necessary to provide long floors in the vicinity of the various molding machines. A comparatively small quantity of sand is sufficient to keep the machine going until a batch of molds is poured, then the molds are taken away and a new supply of sand is dumped on the floor.

The core room, provided with benches and other equipment usually found where small cores are made, occupies all the floor space in the center of the shop not set aside for the preparation of molding sand and that occupied by the melting furnaces. In fact the battery of four large core ovens and one small drawer oven supplied by Foundry Equipment Co., Cleveland, are placed directly back of the melting furnaces as shown in Fig. 1. The remaining floor space, the full width of the shop and extending approximately 100 feet from the end is devoted to grinding, cleaning and inspecting the castings and loading them into trucks for shipment to the adjacent 4-story machine and assembling shops where they are machined, finished, polished, assembled and shipped in cartons of four to dealers.

The method of mixing and handling the sand forms one of the most important steps in standardizing the production of castings. Aluminum is a sensitive metal and readily reflects any difference in the sand in which it is cast Therefore, where castings are held to close specifications, not only in dimensions and weight, but also in surface appearance and homogenity, it is absolutely essential that the sand in which the castings are poured should be uniform. The foregoing conditions have been met satisfactorily by the method adopted at this plant and in addition it has been found that the method not only is more satisfactory from an operating view point, but that it actually is more economical than the former method by which each man prepared his own sand.

The system is built up around a piece of sand handling equipment designed by the Hoover Co. and built by the Link-Belt Co., Chicago, with a rated capacity of 45 tons of sand per hour. The various floors are served in regular order and taking one floor as a typical example the following sequence is observed.

Immediately after the castings are poured a workman detailed for the purpose picks up the entire mold and dumps it into a dump body truck. The flask or jacket, depending on which has been employed to enclose the mold, is stacked

on the floor and the workman continues until all the sand and all the castings are in the truck or bodies. He then goes to the next floor and repeats the performance and as an evidence that he is a fairly busy man it is claimed that one man can dump 2000 molds a day.

An electrically driven lift truck manufactured by Baker, R. & L. Co., Cleveland, follows the flask dumper, picks up each truck load of sand in turn and conveys it to a point near the central sand mixer where the load is lowered to the floor and the sand is dumped through a suitable grating that retains the castings. This feature is illustrated in Fig. 7.

The truck bodies are mounted on suitable frames supported on casters so that when necessary they may be pushed around by hand. They were supplied by the Easton Car & Construction Co., Easton, Pa.

Through the grating in the floor the sand falls on to a moving belt which feeds a bucket conveyor discharging upon a horizontal belt where the sand is sprinkled with water before it passes through a distintegrator and screen and finally into the large storage hopper shown in Fig. 9. From the storage hopper the sand is drawn through bottom discharge gates into dump body trucks and taken to any point on the molding floor by the lift truck.

Many of the small cores are made from sharp sand bonded with oil after the manner of those made in iron and brass shops. These cores form certain openings in castings that do not present any peculiarities in the shape which would set up contraction strains. The large body core destined to form the greater part of the opening in the casting, known as the drum, is in a distinctly different class and must contain two contradictory elements. It must be so soft that it will offer no resistance to the metal while contracting and at the same time it must be rigid enough to withstand a certain amount of rough handling and the pressure of the molten metal.

FIG. 10—THE PATTERN SHOP IS ADEQUATELY EQUIPPED TO HANDLE ALL PATTERNS

Cores which fulfill these requirements are made from a mixture containing old core sand 40 shovels, new core sand 7 shovels, and bonded with a pint of a powdered binder. The large body cores are rapped out of the castings by a vibrator on the end of an air hose. The castings loaded in trucks are taken past the vibrator station on their way to the cleaning room so that really the rapping is the first step in the cleaning process. After the casting has been rapped clean, it is stacked with others in a truck and taken to the band saws where the gates are removed. The sand is shoveled into bins and later into the sand mixer as required. The core rods are salvaged and returned to the core room.

One of the cores is shown in place in the mold in Fig. 8 and a second core may be seen standing on the floor immediately behind the molder on the right. It will be interesting to note that

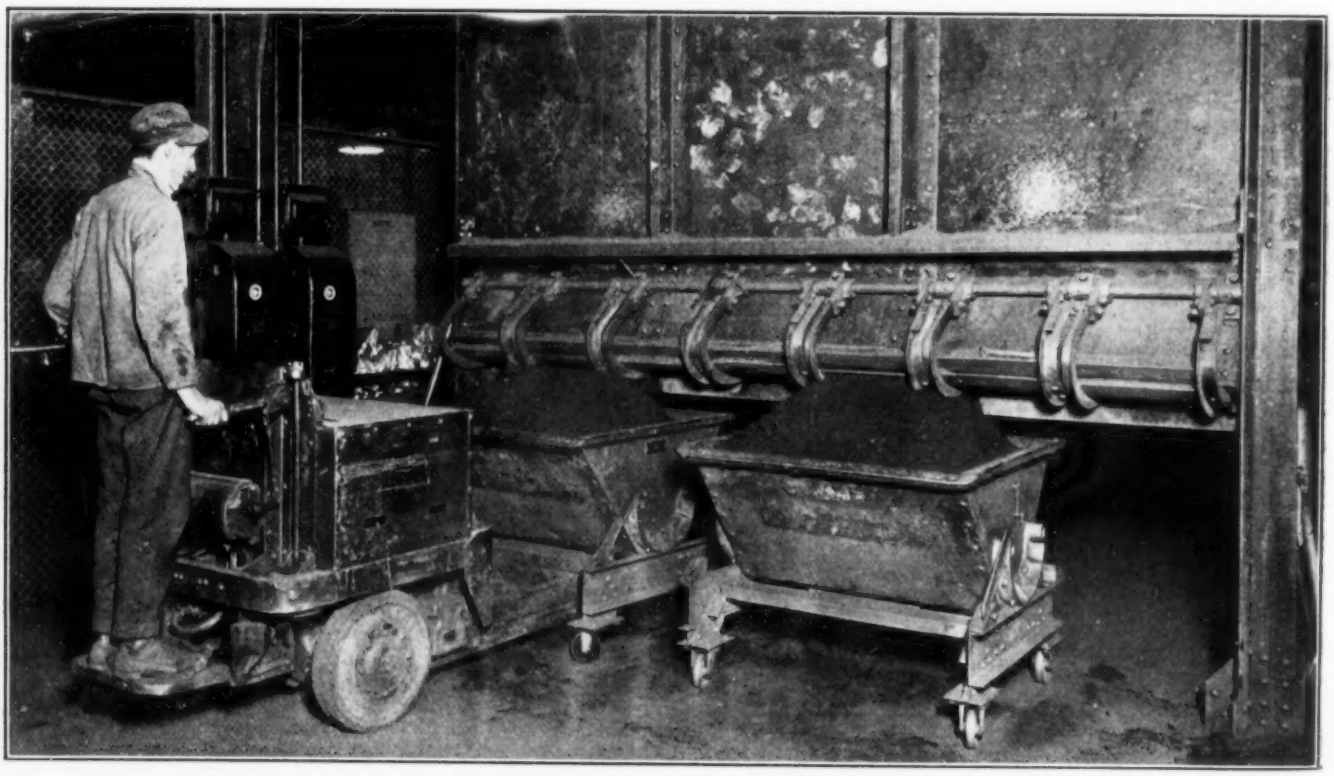


FIG. 9. THE FRESHLY MIXED SAND IS TAKEN FROM A HOPPER AND DISTRIBUTED TO THE VARIOUS FLOORS

these cores are placed on the core oven plates and dried in the position illustrated by the core standing on the floor. The core is made in a 2-part, metal corebox clamped together. Sand is introduced through the round opening at the small end. After the box has been rammed full the coremaker drives a few ¼-inch rods into the sand for reinforcement, then scrapes the sand off flat across the opening in the box. The box then is inverted on the core plate, the clamps are removed and the two halves of the corebox are withdrawn laterally from the core. Before the cores are placed in the oven they are sprayed with a thin solution of the core binder dissolved in water. When the core is dried it presents a hard firm surface and is quite substantial. However, if the skin is broken the sand on the interior crumbles to dust quite readily.

Use Combination Plates

One of the machines on which the drum molds are made is shown in Fig. 6. Cope and drag pattern are mounted side by side and two half molds are made at the same time. The white metal patterns are made according to a method developed by the Arcade Mfg. Co., Freeport, Ill., described in considerable detail in one of a series of articles on pattern mounting that appeared in THE FOUNDRY, Feb. 1 to May 1, 1922 inclusive. This particular process was described on page 284 in the issue of April 1. Briefly it may be stated that the process consists in attaching a white metal thickness to an iron plate previously prepared in the shape of a match plate.

The process involves the making of three molds. The first is poured with plaster, the second with iron and the third with white metal. Where the pattern presents no vertical surfaces, the plaster casting may be omitted, but where vertical surfaces are present it is necessary to make the first casting from a material that lends itself to easy cutting, and plaster is the most convenient medium of that character. Any person who has had experience with match plates knows that while a strip between the joints of the flask will produce any desired thickness of plate, it will not provide any thickness of metal between two vertical faces.

After the non-working vertical faces of the plaster match have been scraped to provide a thickness of 3/16 or ¼-inch, two iron castings are made by using the plaster for patterns. Small tapered cores are located at numerous points on the face of the mold, designed to cut through and serve as anchor holes later for the white metal. Two or more of these holes also serve as gates through which the white metal is poured.

Two final half molds are prepared from the original pattern and skin dried. The prepared iron cope and drag plates are laid upon their respective molds. A shallow wood frame is placed on top of each and after gate pins have been placed wherever necessary and the remainder of the tapered holes covered with a sheet of paper, the frame is filled with sand, rammed, scraped off flush, and after the gate pins are withdrawn the mold is filled with white metal. This metal readily may be finished to a working surface and the iron back renders the plate strong and rigid and prevents distortion.

Several successive steps in molding and pouring the drum casting are shown in Figs. 5, 6, 7 and 8. Two men work on each machine and make an average of 175 molds a day. The output varies to some extent occasionally and has reached 225 under exceptionally favorable circumstances. The cope flask is not provided with bars of any kind and a few small soldiers placed here and there furnish the only support to the hanging body of sand. The method of gating the mold is shown clearly in Fig. 8. Two runners are provided at one end of the mold and a gate with three branches conveys the metal from the runner to the mold on each side.

From an iron foundry view point the volume of metal in the gates and runners is out of all proportion to the size and weight of the casting. They were adopted in this instance only after a long series of experiments with gates of varying sizes. In fact the first castings were molded in the opposite manner to that shown in Fig. 8. The projecting body of sand was formed on the drag face of the mold. This seemed the logical method to adopt and conformed to the almost universal rule to make the most difficult part of the mold in the drag. So far as the actual molding was concerned the method was quite satisfactory, but the loss from defective castings due to slight imperfections on the cope side was excessive.

Copes Pressed Down

The pouring gang shown in Fig. 5 handles the metal. The ladle mounted on a 3-wheel truck in which the front wheel is pivoted, takes the full charge from one of the melting pots and conveys it to one of the molding floors. Here two men with hand ladles pour the molds while a third presses down on the cope sand with a small board to which a handle has been attached. The two halves of the flask are neither clamped or weighted and the pressure exerted by the man with the board is sufficient. It is a convenient method since the hand ladles hold enough metal to pour several molds and the pressure exerted by the metal apparently is so slight that the man holding the board lifts it at the instant the men cease pouring and transfers it to the next flask.

Research Group Extends Its Activities

At a regular meeting of the Electric Steel Founders' Research Group held in Detroit, Feb. 5 and 6, it was decided to expand the scope of the organization's work and to provide for greater activity of the committee on new uses for steel castings. With this end in view W. J. Corbett, industrial engineer, was engaged to be associated with R. A. Bull, research director, in the increased activities of the group in its research work. Mr. Corbett's engineering training has been supplemented by several years of experience in plants of the American Steel Foundries, the Watertown arsenal and the Erie Forge Co. Headquarters of Mr. Corbett will be 639 Diversey parkway, Chicago.

The Electric Steel Founders' Research group is composed of the Electric Steel Co., Chicago, Fort Pitt Steel Casting Co., McKeesport, Pa., Lebanon Steel Foundry, Lebanon, Pa., Michigan Steel Casting Co., Detroit, and Sivyer Steel Casting Co., Milwaukee. The more important investigations now being conducted by the group are said to be those on electric furnace practice, core practice and facing practice.

Buys Stove Concern

The Detroit Stove Co. officials have practically completed arrangements for the acquisition of the Art Stove Co.'s assets, with the exception of the manufacturing plant. W. T. Barbour, president of the Detroit Stove Co., says efforts will be started at once to increase the output of the product of the Art company. Officers of that company are: President William Dwyer, vice president and general manager John O. Campbell, treasurer Harry Kendall, and secretary Hugh Ledyard. Under the agreement, the Detroit Stove Co. acquires the business, trade names, patents and good will of the Art Stove Co.

The Gluntz Brass Foundry Co., 2010 Elm street, Cleveland, began operations Jan. 1, producing a line of general castings in aluminum and the nonferrous alloys up to 1000 pounds each in weight, with a total present capacity of about 3 tons daily. Daniel J. Gluntz is president and general manager.

Makes Preliminary Analysis

Carbon Contents in Malleable Iron Controlled by Analyzing Samples Taken Before Tapping the Heat—If Carbon Is Low Additions Are Made and Steel Lowers Carbon

BY EDWIN K. SMITH

THE process by which malleable iron castings are produced is dependent on a large number of factors, the most important ones being the composition of the original hard-iron castings, and the temperature and duration of anneal.

Years ago, before chemical analysis was in use *scrap heats* were common, and frequently the resulting brittle castings were mixed with good ones, to the detriment of everyone concerned. During the past 20 years, the correct composition and the proper anneal to produce good malleable castings has been determined by chemical analysis. Thus *scrap heats* have practically been eliminated, and a more regular grade of castings are produced.

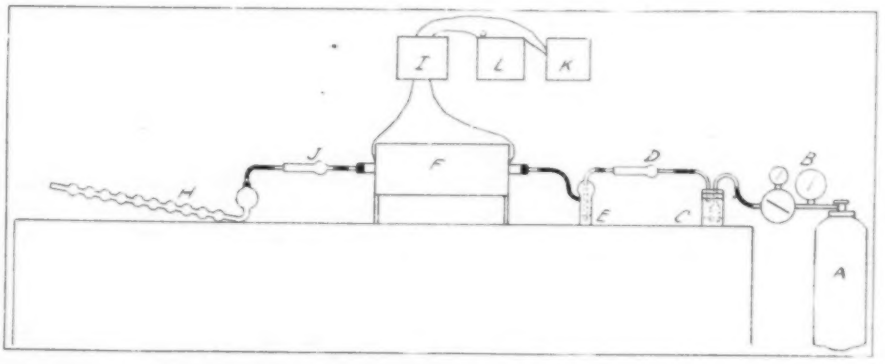
But even now the castings are not entirely uniform. For example, hard iron with 0.60 per cent silicon and 2.80 per cent carbon, will give an annealed iron which would be difficult to distinguish by superficial means from malleable which originally contained 1.10 per cent silicon and 2.20 per cent carbon, yet the physical properties of the castings would be radically different. Again, two hard-iron castings, the chemical composition of which was identical, except that one had 2.20 per cent carbon and the other 2.70 per cent, would on anneal form widely different irons.

Now, the usual practice is to calculate the proper composition for metal charged into each heat, so that the resulting hard iron will be about as desired. The greatest difficulty comes at this point of the process for it is impossible to obtain metal of absolutely uniform composition. It is true that with proper care the composition can be held within fairly close limits, so that a commercially uniform product results. However, there are many variable factors, such as change in quality of fuel, weather conditions, lack of homogeneity of materials charged, etc., which may at times combine to produce considerable deviations in analysis of castings. It may be argued that such differences in composition are of little importance, but it should be kept in mind that malleable castings are being used in increasingly important parts of automotive and railroad equipment, where uniformity is only second to absolute reliability. Particularly is this true in automobile castings, which are subjected to extensive machine operations.

With these facts in mind it has seemed desirable to make each heat poured conform more exactly to the standard analysis determined on in advance. To do this it is first of all necessary to take every precaution to insure constancy of mixture, such as weigh pig iron, sprues, scrap, etc. The best methods of firing, must be employed, standardizing the use of the top blast, etc. Small hard iron tests taken before iron is poured should always be of the same size, and cooled at a predetermined rate. But here difficulties are met which are hard to overcome, for the appearance, or absence of the small spots, by which the tests are judged, is gravely affected by factors exceedingly hard to control, such as temperature and chemical composition of the iron. Owing to these uncontrollable conditions, it is almost impossible to estimate, even roughly, the amount of carbon in the melted metal, and control of the carbon content of hard-iron castings is the most vital phase in the process, where an uniform product is desired. Of course, the obvious way to get an accurate idea of carbon content is to make a carbon determination before the heat is tapped. Such preliminary analysis is standard practice in certain steel and special malleable electric processes.

For this test a sample is dipped from the molten metal, after the slag has been skimmed, and is poured into a clean pail filled with water. A few bits of shot thus formed are placed in a small metal dish which is held over a flame until the shot is quite dry. Sufficient quantity of shot is pounded in a hard steel mortar and immediately delivered to the laboratory.

The crushed sample is poured into the top one of a set of two-high sieves. This sieve is 50 mesh, while the lower one is 80 mesh. All particles larger than 50 mesh remain on the top sieve, and are not used. Particles smaller than 50 mesh drop below, and those smaller than 80 mesh go to a tray at the bottom. Thus the sample remaining in the middle compartment consists of grains sized between 50 and 80 mesh, which size is preferred for analysis for carbon. The particles smaller than 80 mesh are used for silicon and manganese determinations.



DETAILS OF THE CARBON COMBUSTION TRAIN—THE CARBON DIOXIDE IS ABSORBED IN BARIUM HYDRATE

A ½-gram sample is weighed on alundum grains in an alundum boat. Any of the standard combustion methods are suitable for the carbon determination, the apparatus being in operation sufficiently long before sample is received to obviate any delay. The carbon train shown in the accompanying illustration consists of following:

A—Oxygen cylinder.
B—Reducing valves.
C—Home-made valve to determine proper flow of oxygen—sulphuric acid in bottle.
D—Soda-lime tube.
E—Mercury safety valve.
F—Electric combustion furnace.
H—Meyer absorption tube.
I—Transformer.
J—Asbestos and zinc tube.
K—Switch.
L—Rheostat.

With the method in use at this laboratory 16 minutes is required for complete

The author is metallurgist, Wisconsin Malleable Iron Co., Milwaukee.

analysis. This time can be cut down, but for ordinary practice is sufficiently rapid.

The carbon dioxide is absorbed in standard caustic potash which is titrated with standard hydrochloric acid, although numerous other methods give satisfactory results.

To bring the percentage of carbon to the desired standard considerable preliminary experimentation is necessary, as no two melting furnaces work exactly alike. To illustrate, consider a typical case.

Furnace No. 1— Charged 7:30 a. m.
Preliminary sample taken 10:20 a. m.
Per cent carbon reported 10:45 a. m.
Carbon added at 10:50 a. m.
Tapped at 10:55 a. m.
Regular sample taken at 11:10 a. m.

The amount of carbon to be added is a matter of experience, and depends somewhat on the form of carbon used. Some of the available varieties are petroleum coke, graphite, electric-furnace electrodes, coal, etc. Where considerable amounts are used petroleum coke may be compressed into briquettes, together with some kind of binder. Under ordinary conditions petroleum coke, in fine form, may be shoveled on top of the iron, most of it being absorbed. This practice is inexpensive and satisfactory. In case of a great shortage of carbon in the iron, graphite in loose form is absorbed instantly, giving good results.

To decide on the amount of carbon to add it is necessary first to determine the rate at which the furnace burns out carbon. For a week we may take a preliminary analysis at 10:20 a. m., and a final sample at the middle of the pour, about 11:10 a. m. If we find that the average preliminary analysis runs 2.90 per cent and the final analysis 2.40 per cent carbon, and if 2.40 per cent is the amount desired in the hard-iron castings, we call 2.90 per cent standard preliminary analysis for No. 1 furnace, with a 10-ton heat. If the preliminary analysis shows 2.60 per cent carbon, a shortage of 0.30 per cent, or 60 pounds is indicated. It is seen that 0.50 per cent carbon is burned out in 50 minutes, or 0.01 per cent per minute. For convenience, a card can be made for each furnace as follows:

Per Cent Carbon	
Preliminary analyses:	
2.00 to 2.15,	add 160 pounds carbon
2.15 to 2.30,	add 130 pounds carbon
2.30 to 2.45,	add 100 pounds carbon
2.45 to 2.60,	add 70 pounds carbon
2.60 to 2.75,	add 40 pounds carbon
2.75 to 2.85,	add 20 pounds carbon
2.85 to 2.95,	OK
2.95 to 3.05	add 250 pounds steel
3.05 to 3.15,	add 500 pounds steel
3.15 to 3.25,	add 750 pounds steel

Carbon burns out at the rate of 0.01 per cent per minute.

The amounts of steel to add when carbon is too high also are determined by practice. Steel, of course, decreases silicon as well as carbon, thus having double effect. The rate at which carbon burns out in each furnace is stated on the card, so that if for any reason the heat is late a correspondingly extra addition of carbon can be made.

It is sometimes desirable to determine the amount of silicon or manganese by preliminary analysis. Both of these determinations can be made rapidly, any deficiency being made up with ferrosilicon, or ferromanganese. Sulphur also can be determined if necessary.

Preliminary analyses have been found extremely valuable in some emergencies. In one case, the electric power was cut off from the entire plant when the iron was melted but too cold to pour. The furnace was fired by pulverized fuel, so it was impossible to keep iron fluid by hand firing. As the metal froze, carbon and silicon were added. After 4 hours shutdown, the metal being quite solid, firing was resumed. When the iron was melted it was necessary to make two analyses, with corresponding addition of carbon, the heat finally being brought to the normal condition.

As stated previously, the object of preliminary analysis is to obtain a more uniform product, and the results justify the small expense of the analysis. With proper attention to all the details it is possible to hold the carbon content to within 0.05 per cent carbon in either direction. That is, if 2.45 per cent carbon is considered standard, the analysis should not get below 2.40, or above 2.50 per cent.

Equipment Employed For Making Soil Pipe

Question: We have been requested by local interests to consider the advisability of installing equipment for the manufacture of soil pipe, straight lengths and fittings. We are willing, if it can be done for a modest investment. We are not familiar with the method of producing this class of castings and will appreciate any advice you can give us on the subject.

Answer: The manufacture of soil pipe castings is a highly specialized branch of the casting industry and the entire output for the country is supplied by a comparatively small number of manufacturers. The initial expense of installing the necessary equipment is considerable and we doubt if the local demand will amount to enough to offset this first cost. If you expect to develop a wider market you will find yourself in competition with powerful interests that have dominated the national market for years. However, you are more familiar than we are with local conditions, including the factor that soil pipe castings are made by a prominent manufacturer in a large city about 200 miles from yours and therefore we do not presume to offer any advice on the prospect of making the venture a commercial success.

Extended description of the equipment required and methods employed in making soil pipe castings was published in THE FOUNDRY, Jan. 15, 1920 and Dec. 15, 1922. Briefly the methods employed may be described as follows:

The smaller sizes of straight pipe up to and including 5 inches diameter are molded two in a flask and poured through four runners connected to a long central gate from which the iron enters the two molds through many shallow gates. The gate forms part of the pattern equipment and is detachable. It is only used on the plate while the drags are being rammed.

Formerly four hand ladles were employed in pouring the molds, but present day practice favors a ladle provided with four spouts in line and spaced to correspond with the four runners equal distant in a straight line in the center of the cope.

The iron flasks are planed on the joint side and accurately machined on the ends to embrace closely the machined ends of the cast iron core barrels. The flasks are designed to hold a minimum amount of sand and to that end the sides are slanted away from the joint instead of presenting the usual perpendicular appearance. Both cope and drag are barred and no bottom plates are needed. The molds are rammed on an iron pattern plate mounted on four wheels. Two whole patterns which have been turned true in the lathe are mounted in such a manner that the upper surface of the stripping pattern plate coincides with a longitudinal center line on the pattern. A toggle and lever combination serves to drop the patterns about ½-inch before the mold is lifted.

The cores for the straight sections are formed by allowing green sand to fall on a revolving barrel. A strike arranged in a suitable manner regulates the thickness of sand. Patterns for the special fittings, particularly in the larger sizes, are exact duplicates, plus contraction allowance, of the castings they are designed to reproduce. The pattern is split in two along a horizontal center line and both mold and core are made at the same time. In the smaller sizes split patterns provided with core prints are mounted on plates, usually attached to plain type squeezing machines. The green sand cores are formed in hinged coreboxes.

The greatest care and accuracy are required in fitting up the flasks, patterns, coreboxes and arbors and then a suitable grade of sand, fairly close yet porous must be employed in making the molds. The floor is prepared in a special manner by laying two rails or, in some instances, two concrete foundations about 5 feet apart, perfectly level and parallel on which to lay down the completed molds.

FIG. 1—GENERAL VIEW OF THE CORE ROOM SHOWING EXCELLENT LIGHTING CONDITIONS

FIG. 4—INTERIOR VIEW OF CORE OVEN INDICATING THE FLOOR CONSTRUCTION

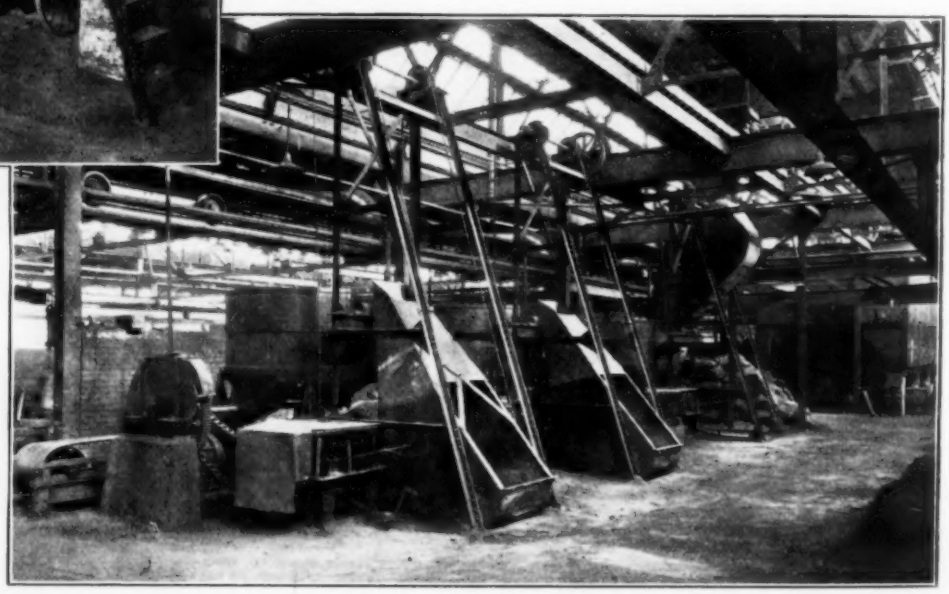


FIG. 2—ABOVE—ONE OF THE ORIGINAL SAND MIXING UNITS WITH FLOOR HOPPER FIG. 3—RIGHT—MACHINES IN WHICH THE FACING SAND IS MIXED

Operating Wilson Foundry--I

Sand Handling Equipment Minimizes Manual Labor—Cores Handled on Conveyors—Separate Department Renews Core Wires and Bends Them Ready for Use in the Cores—Molding and Coremaking Methods Unique

BY D. R. WILSON

THE plant of the Wilson Foundry & Machine Co., at Pontiac, Mich., is unique in many respects. It has been developed by the Wilson brothers primarily for the production of castings for the Overland and the Willys-Knight cars, though the foundry produces jobbing castings for other industries, and during the war made an enviable record on many lines of war castings, and particularly on airplane engine cylinders and gas shells. Eight years ago the foundry was started by the purchase of the old Flanders foundry and machine shop, and these two roof areas today form a part of the regular plant, the expansion having been carried on from the original units until today it ranks among the largest producers of motor car castings in the world.

Fig. 5 shows a general plan of the foundry plant, which is the only part described in this article, and, in fact, this part does not include the cleaning room which is across the track in connection with the machine shop.

As all castings have to start with the consideration of the raw material we will begin with the sand end of this plant, and will consider the metal later. The sand storage building is 80 feet wide and 390 feet long, and has a sand storage capacity of 700 cars of molding and core sand. The cars come in on the track adjacent to the end of the building, and the sand is unloaded by a grab bucket operated by a bridge crane. This carries in the sand and distributes it into the various bins. The mixing room, which occupies a space 40 feet wide by 80 feet long, extends across the sand storage building.

The crane which serves the sand storage also serves to supply fuel to the heating plant. This crane and grab bucket unloads all of the coal, piles it in stock piles, and handles it from the stock piles to the heating plant. It also not only puts all sand into storage, but takes all sand out of storage and supplies it to the mixing machines, or loads it into the dump carts to be hauled to the facing department, or to the foundry for distribution on the sand heaps. The two grades of core sand used are stored on opposite sides of the core-sand mixing unit, and the molding sand is stored at the further end of the building.

Originally the sand-mixing machinery and equipment consisted of two units, each essentially like that shown in Fig. 2. Each unit consists of a batch mixer, elevated and arranged with a floor feed hopper. This equipment was furnished by the Standard Sand & Machine Co., Cleveland. In the old arrangement the sand was taken from the bins through doors in the retaining walls at the sides of the mixing room, and loaded into carts, and dumped into the hopper. A batch was made up in the hopper and then delivered to the mixing machine by the bucket elevator shown. Oil was then added from a little tank at the end of the mixer beyond the conveyor, the measured amount being forced in by compressed air. Where water was necessary in the mixture a measured amount of this also was forced in, being distributed through a spray pipe along the top of the mixer. Careful experiments have been made to determine the proper mixing time for each batch and the machine operator has a clock which enables him to determine the time before the discharge gate is opened. The material is then drawn out into delivery carts as shown under the machine in Fig. 2.

In the more recent installation of equip

Paper presented at a recent meeting of the National Founders' association, held in New York. The author is vice president and general manager of the Wilson Foundry & Machine Co.

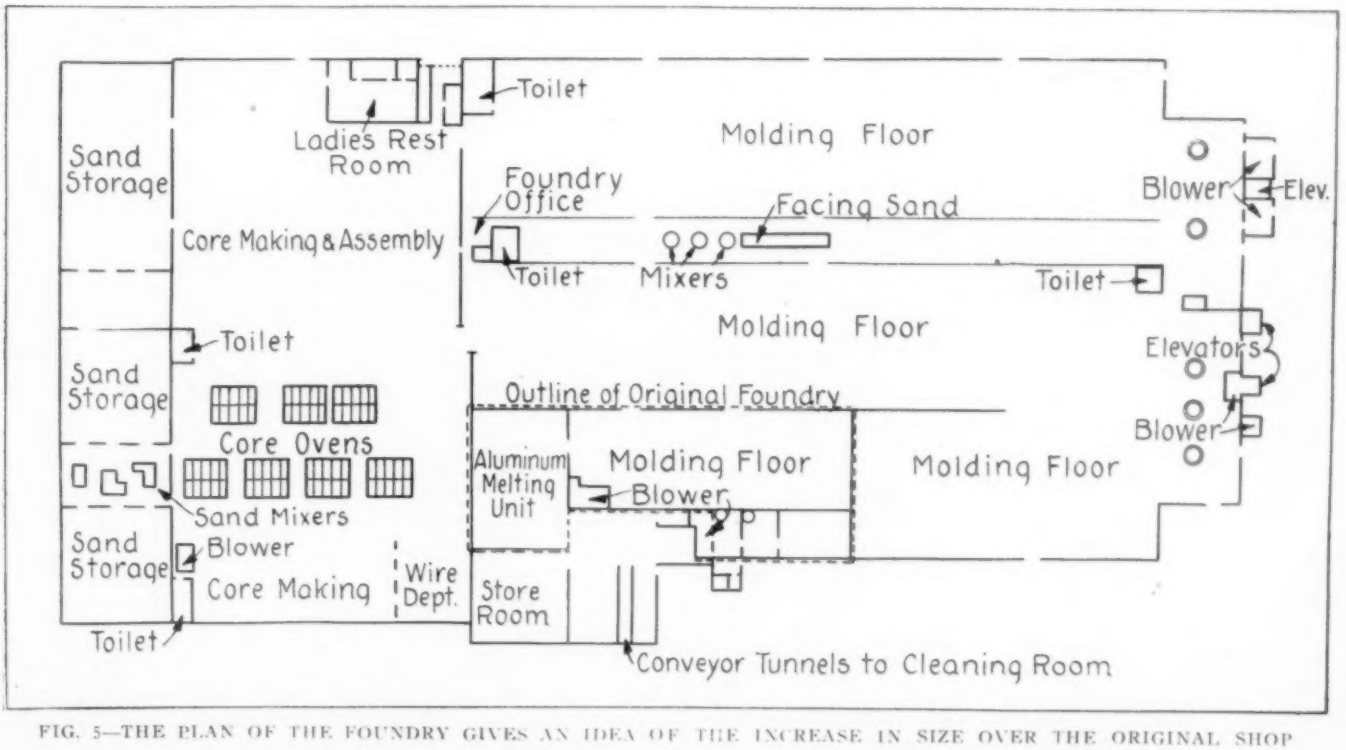


FIG. 5—THE PLAN OF THE FOUNDRY GIVES AN IDEA OF THE INCREASE IN SIZE OVER THE ORIGINAL SHOP

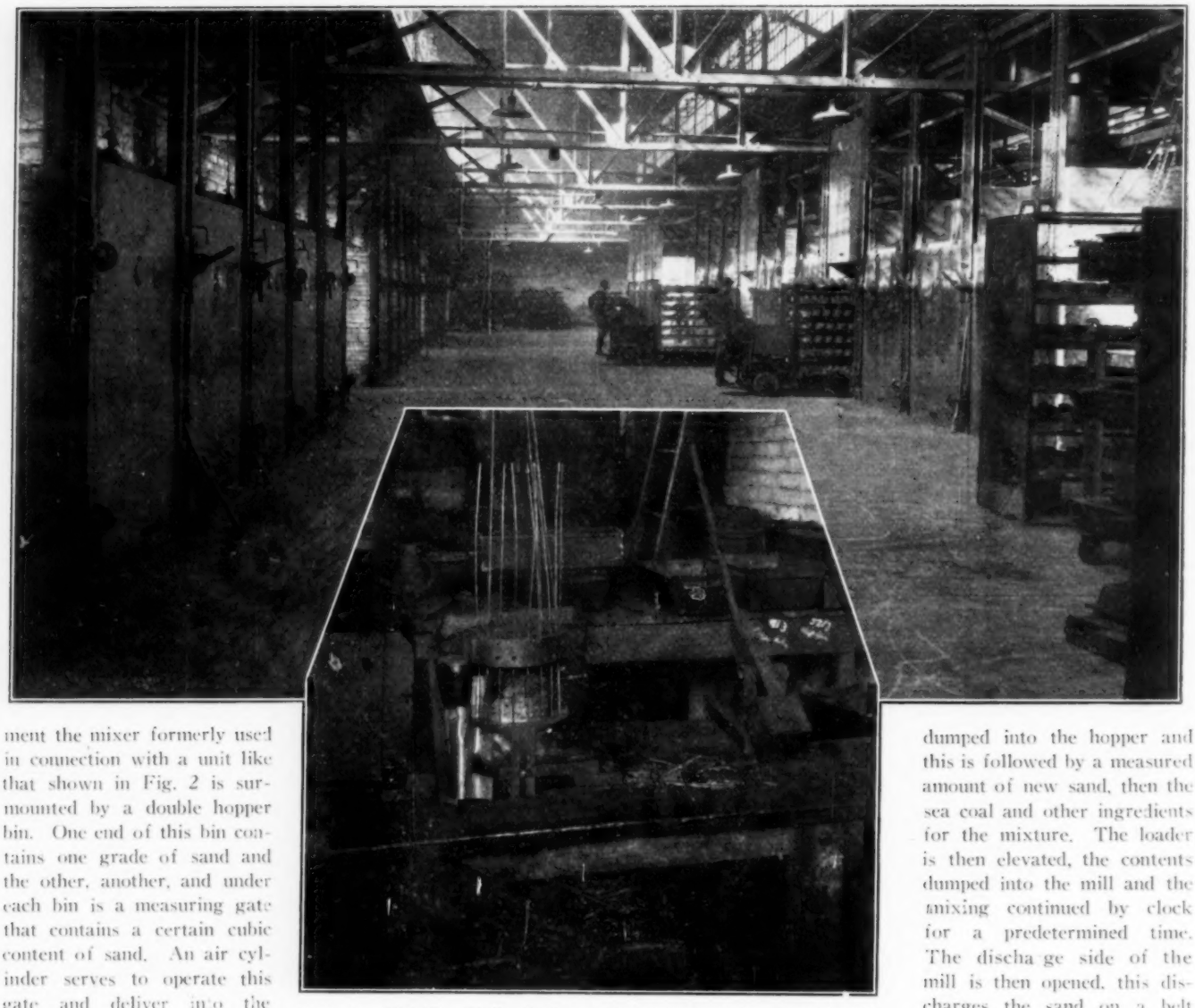


FIG. 6—ABOVE—THE CORE DEPARTMENT IS EQUIPPED WITH 70 FORCED-DRAFT AUXILIARY-AIR OVENS
FIG. 7—BELOW—MACHINE CUTS WIRE TO STANDARD LENGTHS

ment the mixer formerly used in connection with a unit like that shown in Fig. 2 is surmounted by a double hopper bin. One end of this bin contains one grade of sand and the other, another, and under each bin is a measuring gate that contains a certain cubic content of sand. An air cylinder serves to operate this gate and deliver into the mixer a measured amount of sand. The batches are made up with the content of this gate as a unit, and for certain mixtures it may be necessary to move each gate five times, which would give ten times the amount delivered at one stroke as the total mixture, or any other ratio between the two ingredients may be worked out by manipulating the gates in the foregoing manner.

The oil and water are forced in under compressed air by displacement, as already mentioned, and the spray pipe can be seen along the back of the mixer at the top. The sand coming from the discharge gate of the mixer falls directly into the carts, and is taken to the core room as already described.

The arrangement of hoppers over the sand-mixing machine, the delivery of sand into these hoppers, with the grab bucket, and the feeding of the mixing machine by the pneumatically controlled gates has reduced the expense of mixing sand about 50 per cent when compared with the old method of floor hoppers which necessitated the shoveling of the sand into the carts and its subsequent dumping into the hopper.

While on the subject of sand it may be well to say something about the mixing of facing sand for the foundry. Facing sand consists of a certain portion of old sand and a certain portion of new sand, together with the sea coal and other ingredients required.

Fall Into Carts

The new sand from the sand bins is brought in dump cars by means of a tractor. These dump cars are filled by the grab bucket in the bins, and the new sand is dumped on the floor as shown at the right of Fig. 3. At the left may be seen a battery of three 6-foot mixers with loading devices made by the National Engineering Co., Chicago. The first two loading devices are down in the filling position, and the one in the background is raised to discharge its load into the mill. A measured amount of old sand is dumped into the hopper and this is followed by a measured amount of new sand, then the sea coal and other ingredients for the mixture. The loader is then elevated, the contents dumped into the mill and the mixing continued by clock for a predetermined time. The discharge side of the mill is then opened, this discharges the sand on a belt conveyor back of the mills, the end of which may be seen at the extreme left in Fig. 3. This belt conveyor carries the sand to a point where it is passed up by a bucket elevator and discharged upon a drag conveyor running over the bins. The facing sand is drawn from these bins into carts.

The wetting necessary for the facing sand is added in the mill, and great care is taken to see that the proper amount of water is used in the tempering. All of the features entering into the mixing of both core sand and facing sand and all of the binders and other ingredients are under laboratory control and supervision.

We now turn to the coremaking department proper. A glance at the plan will show that this department extends across the end of the foundry building for 390 feet. At the side next to the track is located the coremaking and wire bending departments. In the center are the ovens. On the opposite side another coremaking department, the assembly department, and the core storage department, together with the girls' rest room. The men's locker

rooms and shower baths are housed over a portion of the core room.

Fig. 1 gives a general view of a portion of the coremaking department, showing the racks used for the transfer of cores, and at the left a machine furnished by the Grimes Molding Machine Co., Detroit, for making four Overland jacket cores at one time. This process is described more fully later.

The view shown in Fig. 1 gives a good idea of the splendid light conditions in the core room, and of the freedom of movements. At the particular time of the day this picture was taken the core racks had been moved forward to the ovens.

Sand in Back of Benches

Coremakers' benches are of the back-opening type. The sand is delivered from a sand alley between two rows of benches, and is shoveled over the back of the benches, so that the girls are not disturbed in their work by the delivery of sand. The benches are individual so that one girl's operations do not disturb another. Opposite each girl is a set-off bench on which she sets her cores as they are completed, and when the plate is filled it is placed on the rack immediately behind the operator.

Seventy core ovens are located in the center of the department. These are of forced-draft auxiliary-air type, and each oven is of sufficient size to contain two racks in tandem. The racks are taken in and out of the ovens with electric lift trucks. The ovens are arranged in batteries of ten each, as shown in Fig. 6, being placed in groups of five, back to back. Each battery is fired by a single firebox. All fireboxes are under the floor level, and all firing pits are under forced draft conditions. Fig. 4 gives a direct front view of one of the more recent ovens, showing the floor construction. On a level with the core room floor is a steel floor which supports the racks during the drying operation. The heat enters the oven at the floor level at the back, ascends and circulates about the cores, and the moist air descends into the pocket below the floor level beneath the mezzanine floor. The waste gases are taken off about 30 inches below the floor level. The doors are heavily insulated and the ovens dry with a minimum amount of coke per ton of core sand dried. These ovens are patented by H. M. Lane, and were installed by Holcroft & Co., Detroit.

All core oven operations are under accurate temperature control, the ovens being equipped with recording electric pyrometers. The firing of the ovens is so conducted as to furnish the desired amount of heat, and the exact regulation of each oven is accomplished by means of dampers.

All operations in connection with the foundry are under a shop committee headed by the division superintendent. A careful study has been made of every angle of the work, so that patterns, coreboxes and everything entering into the operation are really tool room jobs, and all are interchangeable.

No coremaker is allowed to bend any wires, and only the particular set of standard wires determined to be the best for any given core are allowed to be used in that core. Much of the wire is recovered, straightened, and used over again, and this has resulted in the development of a highly specialized core-wire department. A general view of this department is shown in Fig. 8. In the foreground may be seen benches fitted up with special wire bending jigs, which have been made in the tool room. A given number of wires are counted out, bent, and delivered to the coremakers requiring them.

FIG. 9—THE WIRE DEPARTMENT IS EQUIPPED WITH AUTOMATIC CUTTING AND BENDING MACHINES AS WELL AS WIRE STRAIGHTENING AND CUTTING MACHINES

FIG. 8—CORE WIRE IS HANDLED IN A SEPARATE DEPARTMENT—SPECIAL BENDING JIGS ARE SHOWN IN THE FOREGROUND

Wire Cutting Machinery

Some of the more simple bends can be made automatically by machinery. Fig. 9 shows in the foreground an automatic machine which takes wire from a coil, straightens it, cuts it to length, and puts a right angle bend in it. This was built by the Baird Machine Co., Bridgeport, Conn. Back of it may be seen a battery of several machines which were furnished by the B. F. Shuster Co., New Haven, Conn., and the Worthington Pump & Machinery Co., New York. These several machines serve to straighten wire and cut it to length.

From the straightening machines comes a considerable amount of recovered wire of random lengths which is not suitable for use as it is. Some of this can be sorted into given lengths, rebent and reused without cutting, but much of it is cut into

FIG. 10—ROLLOVER MACHINE MAKES FOUR JACKET CORES AT ONE TIME

shorter lengths for rebending. To accomplish this the special machine shown in Fig. 7 has been designed and built. This consists of a revolving turret head from which the wires are dropped against a gage plate. At one edge of the machine is a pair of rotary shears which cut the wire, after which it drops into the boxes below.

Much thought has been expended in the perfection of the devices in this room, and upon the proper rodding and wiring of the cores. On this depends much of the subsequent success in the casting operations.

Operates on Schedule

All work is scheduled through the core room, and where possible cores are assembled, pasted into groups, and jig tested before sending them to the foundry for use in the molds. Every evening all of the cores for the next day's work are lined up on the assembly floor. Thus the core room is always a full day ahead of the foundry.

Now following through a few of the jobs, and hitting some of the high points illustrating special methods of manufacture, will probably be of interest.

Several illustrations in connection with the production of the Overland motor are first shown. Fig. 10 shows a detail view of the coremaking machines making jacket cores. This machine is is so located with regard to the core bench that the operator can introduce the sand with a minimum of labor, and after the wires have been placed, the boxes filled

FIG. 12—CRANKCASE CORE GRINDER AND SECTION OF CONVEYOR

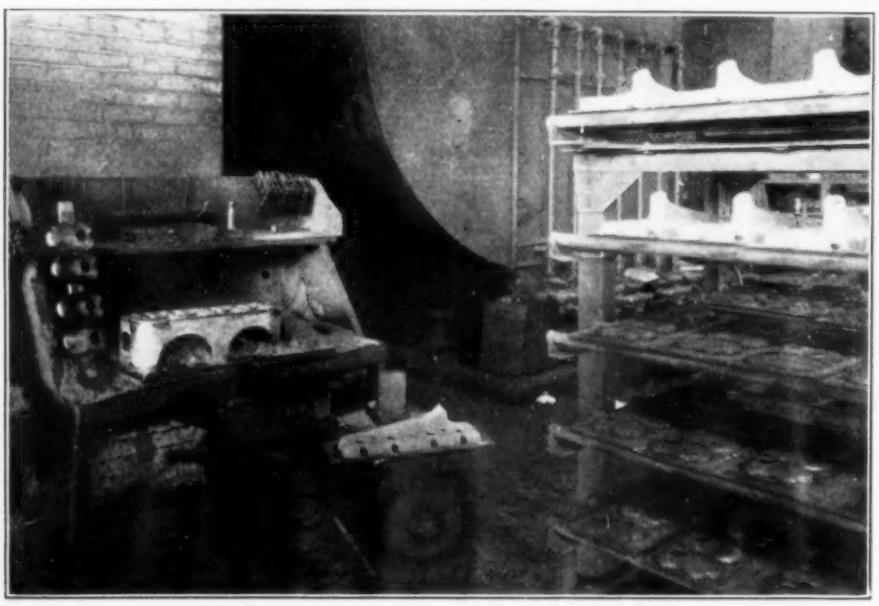


FIG. 11—CYLINDER-HEAD CORES FOR THE OVERLAND MOTOR ARE MADE ON A BENCH WITH THE EQUIPMENT SHOWN HERE

with sand and struck off, a series of four driers is laid across the back, and the core plate clamped in position. The whole is then rolled over, the corebox vibrated, and drawn away as shown. At the left, standing on the stool, is a group of four jacket cores with their driers in place on the core plate.

These core plates are all cast iron, and are carefully machined to insure positive alignment. All the driers also are machined, and are frequently tested to be sure that nothing is going out of alignment.

Simplifies Core Handling

Fig. 10 also shows another feature which is universal in the practice of the Wilson foundry. When the cores are stripped from a core rack the plates and driers are returned to the

rack, and then the rack with its plates and driers on it is returned to the coremaker. This simplifies the handling of plates and driers and assures the coremaker a constant supply ahead of his operations. The rack, a portion of which shows at the left, Fig. 10, has four upper shelves containing completed cores. At the fifth shelf from the top a space is ready to receive the core plates shown in the foreground and the completed plate about to be taken from the machine. The lower shelf of the rack contains plates with driers in place ready for the coremaker.

Fig. 11 shows the equipment for making the Overland cylinder-head core. On the bench may be seen the aluminum coreboxes, and at the left the printing device which forms the depression subsequently filled by the driers shown on the core plates on the rack at the right. The various special wires used in the job are shown on the shelf in front of the coremaker's position. Attention is also called to a special device attached to the set-off bench to assist in drawing the boxes. The box is rolled over on the core plate as shown and then is lifted off being guided by the angle plate shown back of the core. The upper two shelves of the rack are filled with finished cores while the other four shelves contain core plates, each with its set of four driers. All of these driers are accurately jigged to size to insure perfect interchangeability of cores.

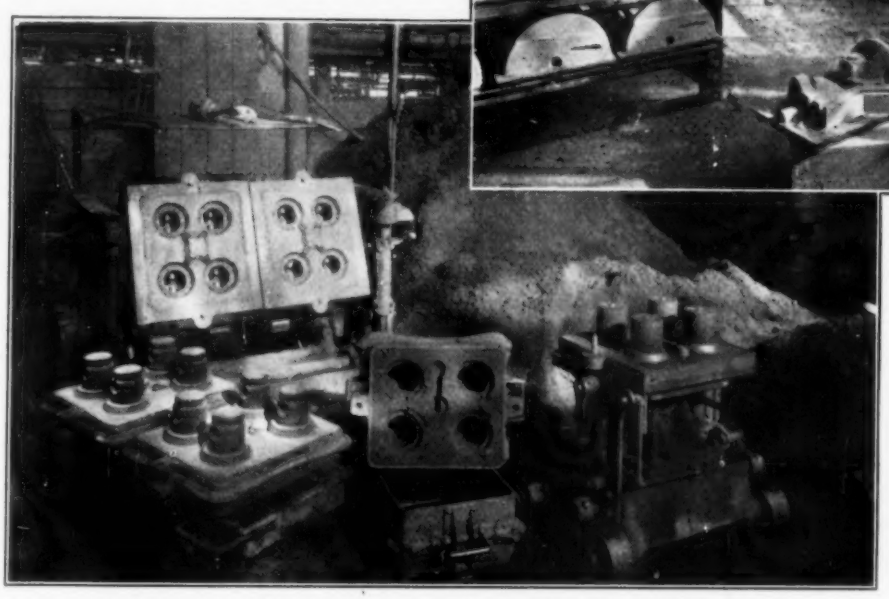


FIG. 13—GREEN-SAND CORES ARE USED FOR PISTONS—BOSSES IN THE CORE BOX ARE STRIPPED OUT BEFORE THE FLASK IS DRAWN AWAY FROM THE PATTERN

We might continue showing the making of many other cores for this job, but these two examples have shown the general principle and the general method of assembling the work. We will now turn to the core assembly. Fig. 12 shows the Overland crankcase grinding jigs. These are machined stops or jigs onto which the cores are set. There are four of these on a revolving table. The operator first blows off the contact surfaces with the air hose shown suspended in the foreground, and then places the cores in position. Some cores are shown on the floor at the right, but under working conditions the cores do not touch the floor at all, but are taken directly from the rack, placed on the jig, and rotated under the revolving disk wheel which grinds the surface, rendering it smooth, and assuring a definite relationship between the parting faces of the cores, and all of the jig points on the outside. The cores are then placed on boards on the roller carrier shown at the right, and proceed toward the right, and subsequently make a half-turn.

As the cores pass along the carrier each operator looks after some special point, either gaging, cleaning out vents, putting in stopping for the holes, or performing other necessary operations for the finishing of the core. Half-way down the carrier the cores are sprayed. At the discharge end of the carrier the cleaned, inspected and blacked cores are taken off and put on racks ready for delivery to the foundry. The blacking used is of such a character that it air dries before the cores are used the next day, and it is not necessary to pass them through the oven the second time. It is only in the case of pasted cores that oven drying of the material is either required or necessary.

FIG. 14—MAKING TRANSMISSION CORES FOR THE KNIGHT ENGINE

The jacket cores are assembled on a similar arrangement to the one just described and, as in that case, each operator has some special duty to perform.

We now proceed to the foundry and to the molding of this job. This particular job is being molded on a machine of the sand-slinging type built by the Beardsley-Piper Co., Chicago. A general view of the floor is shown in Fig. 17. The machine advances into the sand heap, picking up the sand, riddling it, and delivering it into the mold. Particular attention is called to the special traveling crane arrangement following the machine, and attached to the machine by a lead chain, so as to maintain a constant relationship between the crane and the machine. This really consists of two crane frames joined together by suitable steel work, and supporting two underslung pneumatic cranes carrying air hoists. One of these air hoists is shown at the extreme left, and it may be seen that the trolley travel of the air hoist is parallel with the travel of the molding machine, or in other words, with

FIG. 15—CORING CYLINDER MOLDS

the total length of the molding floor.

Holding the Molds

The sand-slinging machine has ramming positions for both cope and drag portions of the mold. The flasks are placed in position and rammed successively. One of the air hoists then picks up the finished portion of the mold, and sets it on the floor, as shown in Fig. 15, which is taken from the opposite side of the sand-slinger machine. In this view it may be noticed that the two special molding machines or pattern-drawing devices which the sand slinger serves, are mounted on rolls and dragged along with it. The drags are set down on the floor in a row, and wooden platforms are placed on the row of molds last finished. Each one of these wooden platforms first is loaded with a complete set of cores to core the mold in front of it. The coring gang then proceed along the row of drags, assembling the cores in the mold, and testing each stage in the assembly with suitable jigs. In the left foreground, Fig. 15, may be seen a mold which just has had the cope placed in position, and the runner box rammed up, the runner box pattern being seen behind the runner box. The next two molds to the right are completely cored ready for copes. While the coreing gang is working toward the right the flasks are set down in rows of ten each, back to back, as shown, with casting aisles left across the floor between every two rows. The pouring is subsequently done with another crane and bull ladle by a method shown in connection with other floors.

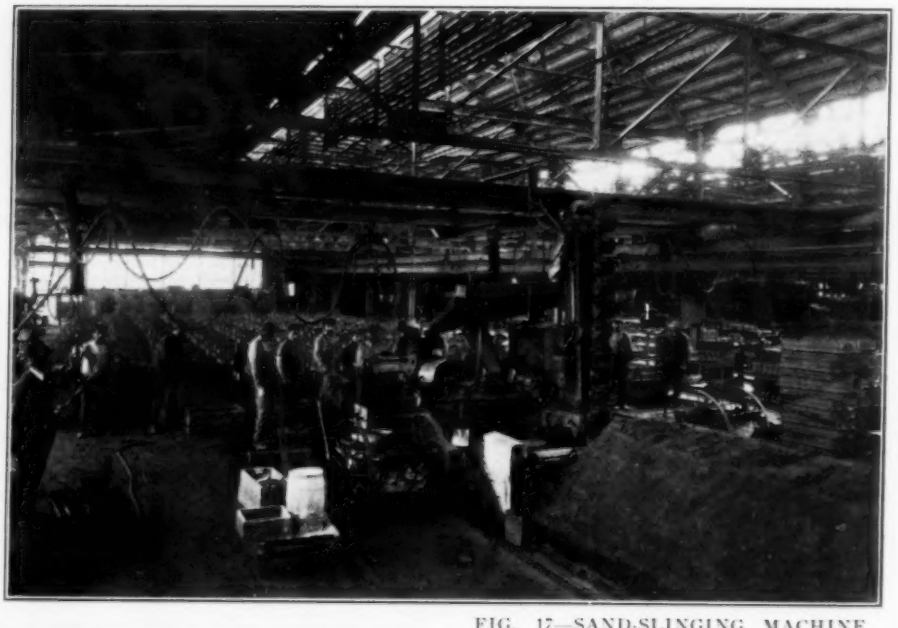


FIG. 17—SAND-SLINGING MACHINE MAKING CYLINDER MOLDS

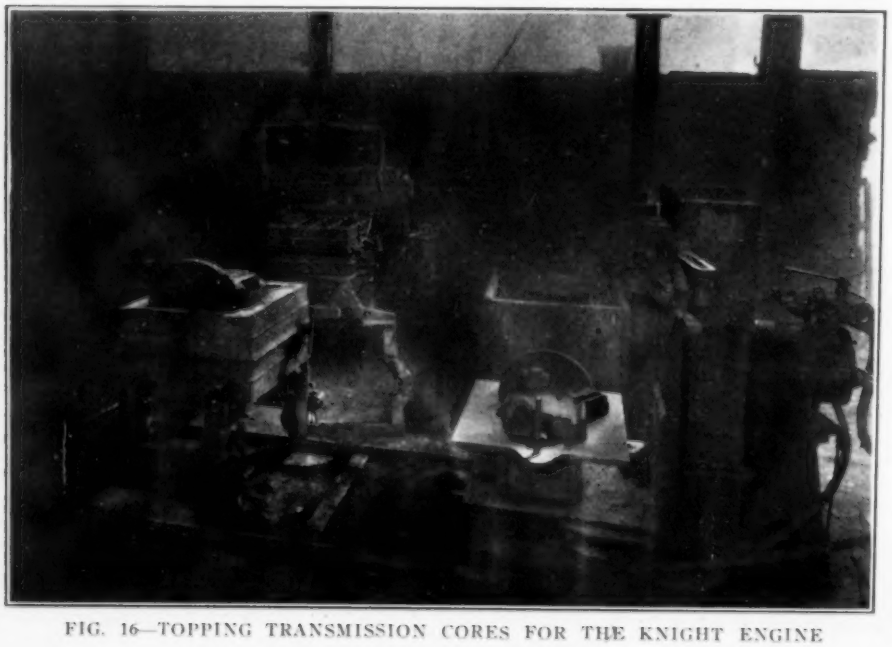


FIG. 16—TOPPING TRANSMISSION CORES FOR THE KNIGHT ENGINE

Working with the sand-slinger outfit 14 men ram, core, and prepare for pouring 300 cylinders in 9 hours, and the machine handles 3500 cubic feet of sand, or about 140 tons per day.

Green-Sand Piston Cores

The piston for the Overland car is an all-green-sand job. The rigging for accomplishing this is shown in Fig. 13. At the left is shown a specially rigged molding machine with a special corebox rigging on it, in connection with which the bosses in the corebox can be withdrawn or stripped out over the sides before the flasks are drawn down away from the patterns. The two completed drags are shown at the left, as the machine makes two drags at a time, and each contains four pistons.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

SAFETY CODE FOR FOUNDRY WORKERS

INTRODUCTION

Section 1. *Scope*—This code deals with foundry conditions only, omitting such subjects as building construction, exits, stairways, elevators, lighting, sanitation, etc., as these subjects are covered by other codes.

Section 2. *Interpretations and Exceptions*—The purpose of this code is to provide reasonable safety for life, limb and health. It shall be liberally construed to secure results, by the enforcing officers of body, who shall have the authority in cases of practical difficulty or unnecessary hardship, to grant exceptions from the literal requirements of this code, as long as equivalent protection is thereby secured. When the safeguarding of particular types of machines is covered by other approved codes, these codes shall be given the preference. Where specific devices or methods are mentioned in this code, other devices or methods which will secure equally good results may be used, subject to the approval of enforcing officer of body.

Section 3. *Application of Regulations*—Regulations affecting industrial establishments generally in respect to the safeguarding of transmission machinery, miscellaneous machinery, elevators, stairways, platforms, or relating to sanitary conveniences and first-aid equipments, not included in this code, shall apply with equal force to foundries.

Section 4. *Suspension of Regulations*—This code may be modified or suspended in whole or in part by the proper state authority in respect to existing foundries if good and sufficient reason therefor is submitted.

Section 5. *Mandatory and Advisory Requirements*—The word "shall" where used, is to be understood to be mandatory, and the word "should" advisory.

Approved as tentative American standard by the American Engineering Standards committee and sponsored by the American Foundrymen's association and the National Founders' association.

(*Continued on Data Sheet No.* 470)

SAFETY CODE FOR FOUNDRY WORKERS

(*Continued from Data Sheet No.* 469)

Section 6. DEFINITIONS

Rule 60. *Foundry*—A foundry shall mean a building where iron, steel, tin, zinc, lead, aluminum or compositions containing any of the baser metals are melted and poured into molds for the making of castings, and shall include all molding, coremaking, melting, cleaning, toilet and washrooms used in connection therewith.

Rule 61. *Entrances or Exits*—The term "entrances" or "exits" shall mean passages for common use between the foundry and the open air, provided for employes during working hours.

Section 7. For standard method of guarding general hazards and for sanitation reference should be made to codes prepared under the procedure of the American Engineering Standards committee.

PART I—PLANT LAYOUT

Section 10. ENTRANCES

Rule 100. *Protection*—Entrances to foundries located in cold climates shall be protected during the winter by covered vestibules or their equivalents, which shall be so constructed as to eliminate harmful drafts, and of such dimensions as to answer ordinary purposes, such as the passage of wheelbarrows, trucks and industrial cars.

Rule 101. *Exception to Protection*—Section 10 shall not apply to entrances used for railroad or industrial cars handled by locomotives, or for traveling cranes, horse-drawn vehicles or automobiles; these entrances may remain open during the winter only for such time as is necessary for the ingress and egress of such cars, cranes, horse-drawn vehicles or automobiles.

Section 11. FLOORS, PITS AND GALLERIES

Rule 110. *Floor at Cupola*—The floor beneath and immediately surrounding a foundry cupola shall be kept free from collection of water.

Rule 111. *Cleaning and Finishing Floors*—All cleaning and finishing floors shall be cleaned and leveled as often as necessary to secure safe working conditions.

(*Continued on Data Sheet No.* 471)

At the right is shown a small stripping-plate machine used for making the copes, and in the center of the illustration is shown one of the copes. This group of machines makes rapid progress in producing this type of pistons. The use of green-sand piston cores takes a big burden off the core room, and the absence of dry-sand cores gives a longer life to the sand heap.

The accuracy of these methods of molding can be judged by the fact that all finished pistons are kept within a limit of 1 ounce variation in weight.

Fig. 14 shows the rigging for producing half of the Willys-Knight transmission core. These cores are made on rollover machines, built by the Grimes Molding Machine Co. The machine in the foreground is shown clamped ready to roll over, while the one in the background is shown with the corebox ready to be filled and rammed. At the left is a rack filled with cores for drying, and in the center foreground one of the cores is shown on a core plate ready to be placed on the rack.

The mold into which these enter is made with half green-sand and half dry-sand core, and the machine for producing and setting the core is shown in Fig. 16. In this illustration the green-sand core is made in the corebox, which is below the flat plate shown. As soon as the half-green sand core is rammed up and struck off, the locating frame, shown standing next to the mold, is placed over the pins on the plate and the half-dry-sand core, made as shown in Fig. 14 is located on top of the green-sand core. In the illustration the frame has been removed, leaving the dry-sand core perfectly fitted over the green-sand core. Next, the drag, made on the machine shown in the background, is set on top of the dry-sand half core, the clamping frame swung in place, the drag clamped, and the entire assembly rolled over. The corebox is then drawn off from the green-sand core leaving it supported on the dry-sand core in the drag, as shown in the mold on the carriage at the left. This assembly is then lifted to the floor and the cope placed in position.

Standardizing Taper on Round Cores

BY WILLIAM J. WARD

METHODS of tapering round cores vary depending on whether the cores are made in a jobbing foundry where probably only one casting of a given pattern is ordered or in a specialty shop where thousands of castings are made from the same pattern. The jobbing molder can go to the coreroom, select a length of straight core and taper the ends to suit his requirements. Lack of skill or judgment will result in a spoiled casting. If the core is too long it will push the cope and probably cause a quantity of loose sand to fall into the mold. If it is too short, or if the tapered end fits loosely in the cope core print, the resulting hole in the casting will be off center in the case of a cylindrical casting and proportionally out of place in any other shape of casting. A satisfactory method of designing and attaching core prints is shown in the accompanying illustration.

The cope core prints are cut with a 14-degree taper as shown in Fig. 1 and the metal corebox is shaped to correspond as shown at Fig. 2. The cores are made singly and rolled out on a plate. Where many of these boxes are required it is advisable to prepare a master box about 12 inches long. This box may be used as a pattern in the foundry where the mold may be stopped-off to any desired length, or the casting may be made full length and then cut to length in the metal pattern shop.

Core prints may be attached to the pattern in the manner shown in Fig. 3. For wood patterns all prints up to ⅞-inch are made with a ⅜-inch dowel. A ⅜-inch hole is bored right through the pattern wherever possible and the prints are pressed in as shown to the right in Fig. 3. Larger prints are provided with correspondingly larger dowels. This method facilitates interchanging of core prints. For metal patterns the hole is bored the desired diameter and a solid piece of stock long enough to extend through and form a print on each side, is forced in from the cope side. The piece of stock is slightly tapered and therefore any subsequent tapping on the top will tend to tighten rather than loosen the prints.

Ninety-eight establishments were making babbitt metal and solder in 1921 compared with 111 in 1919 and 95 in 1916, states the United States census bureau. The number of persons engaged was 2089 in 1921, 3372 in 1919 and 1686 in 1916. Salaries and wages totaled $3,476,000 in 1921, $5,053,000 in 1919 and $1,614,000 in 1916. The cost of raw materials used was $22,355,000 in 1921, $48,844,000 in 1919 and $15,652,000 in 1916. The total value of products was $26,255,000 in 1921, $59,017,000 in 1919 and $19,180,000 in 1916.

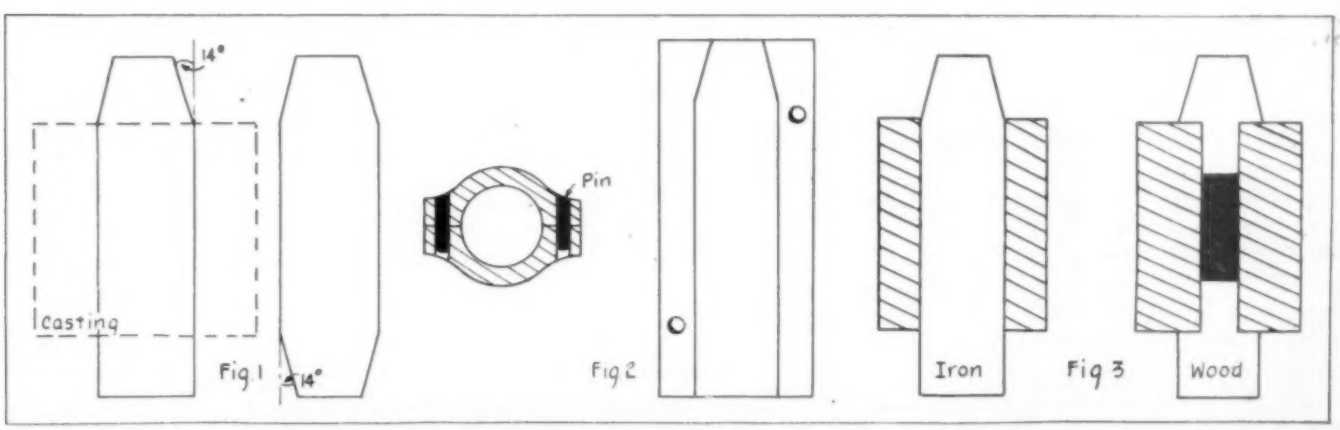


FIG. 1—CORE PRINTS ARE PROVIDED WITH A 14-DEGREE TAPER FIG. 2—TYPE OF METAL COREBOX EMPLOYED FIG. 3—METHOD OF ATTACHING IRON AND WOOD CORE PRINTS

Correcting Flaws in Metal Mixtures

Problems of the Gray Iron, Malleable and Steel Foundry Discussed

By H. E. Diller

Valve Castings Porous

Question—We are having trouble in getting valve and pipe castings to stand 360 pounds pressure, using the following mixture:

	Pounds
Pig iron	350
No. 1 scrap iron	150
Steel boiler plate	300
Standard car wheels	200

The analysis of the pig iron is silicon, 3.7 per cent; manganese, 0.80 per cent; phosphorus, 0.60 to 0.80 per cent; sulphur, 0.05 per cent. The No. 1 scrap contains about 2.00 per cent silicon. We have tried chilling the heavy parts, with a fair amount of success, and we pour the castings with high head pressure and very hot. Is there any way to redeem these leaky castings?

Answer—You could lessen the amount of porosity found in your castings by decreasing the amount of steel boiler plate used in the mixture by half and adding scrap iron in its place. You should also look to the design of the valve to see that the flanges are of as light section as possible and that there is a fairly large fillet where the flange joins the casting. Iron with lower phosphorus also would be an advantage. The phosphorus could be run as low as 0.2 per cent.

Castings which leak can be saved by allowing them to stand in the weather for several months, or by forcing a solution of sal ammoniac into the pores. This will then cause the iron to rust and so close the openings. A thin solution of water glass also may be used for closing the pores by forcing it into the castings. However, by far the better way is to make sound castings.

Composition for Gears

Question—Please advise us as to a mixture for the following castings: Bevel gears weighing 22, 40, 60, and 320 pounds each; spur gears weighing 40, 100, and 600 pounds each; chain sprockets weighing 270 pounds.

Answer—For the castings you list, a mixture should be used consisting of 15 per cent steel scrap, 35 to 45 per cent gray-iron scrap and the remainder pig iron. The iron should be of such a composition that the castings will contain not more than 0.12 per cent sulphur, 0.3 to 0.6 per cent phosphorus and 0.6 to 0.8 per cent manganese.

The silicon content will be governed somewhat by the design of the casting but we should judge that the silicon in the 320-pound bevel gear, 600-pound spur gear and the 270-pound chain sprocket should be between 1.5 and 1.75 per cent while the other castings should be made of iron with silicon ranging from 1.75 to 2.0 per cent.

Box End Castings Should Be Made of Steel

Question—In England we make a casting called a *box end* which is riveted to the ends of a trough made of soft steel plate to form a receptacle for charging the stock into open-hearth furnaces. We usually cast these of steel, but a customer desires us to make them of cast iron. Would semisteel be better? If so, should we use cast-iron scrap in the mixture? Also, is the custom of making these boxes entirely of cast steel in general practice in America?

Answer—Undoubtedly the addition of steel to the mixture in the cupola will strengthen the iron. Fifteen per cent of steel together with 35 per cent scrap iron added in the mixture will be more beneficial than a mixture without either of them. The steel should be charged on top of the coke, then the scrap iron and finally the pig iron, and care should be taken to see that enough coke is added on each charge to get hot metal.

The composition of the casting which you mention should be silicon, 1.25 to 1.75 per cent; sulphur, below 0.12 per cent; phosphorus, below 0.5 per cent, preferably between 0.2 and 0.3 per cent; manganese, between 0.5 and 0.8 per cent.

Box ends almost universally are made from cast steel in America as the iron would break quickly the way the boxes are handled. Boxes are made of cast steel ends with steel-plate bodies riveted to the ends; also they are made entirely as steel castings. Conditions at your works will have to determine which of these two should be used.

Limit Steel Percentage in Malleable

Question: I understand that only small percentages of steel scrap are used in making malleable iron in the air furnace. Please let me know how much steel scrap generally is used for this purpose and why more is not used.

Answer: Usually 5 per cent of steel scrap is used in making malleable iron in the air furnace, although sometimes as much as 10 per cent is added to the mixture. Steel increases the tendency of the resultant metal to crack, and being of such a radically different composition from the other ingredients of the bath, the metal probably will not be uniform as it comes from the furnace if the bath is not thoroughly mixed when steel is used. Still another reason for not using more steel in the mixture is that considerable carbon is burned out of the iron during melting and if too much steel is added the amount of carbon in the iron as cast will be lower than desired. No foundry of which the writer knows uses malleable iron with less than 2.00 per cent carbon as it comes from the furnace and the general average would be between 2.30 and 2.50 per cent carbon.

Galvanize Iron Castings

Question—How can we galvanize gray-iron castings by the hot-dip process so that the zinc will stick? The zinc does not stick to the casting at all places.

Answer—You would, no doubt, secure good results if you clean your castings in dilute hydrochloric acid, watching that the casting is not kept in the acid longer than is necessary to remove the scale. After taking the casting from the acid, it should be dipped in water, then in a solution of sal ammoniac and ammonia. This solution may be made by adding zinc to the hydrochloric acid until action ceases, then adding ammonia until the precipitate that is formed and redissolved. Be careful not to add an excess of ammonia. Zinc chloride also can be used as a solution, or as a solid made into a concentrated aqueous solution, after which ammonia is added in the usual way. From here the casting is dipped into the molten zinc, taking care that it is dry before putting it into the zinc.

Bu[illegible]ds New Induction Furnace

Se[illegible]ry District from Melting Chamber Between Which Is Kept a Con-[illegible]s, Automatic Circulation of Molten Metal—Danger of Magnetic [illegible]hoking Is Avoided—Refractory Lining Only Limitating Feature

BY J. MURRAY WEED

A NEW [illegible]duction furnace has been desig[illegible] [illegible] melting nonferrous metals[illegible] this particular furnace, as in [illegible]other induction furnaces, the heat is produced by an electric current induced by transformer action in a looped portion of the molten charge, called the secondary. This secondary is distinct from the melting chamber pot, in which the cold charge is received, melted and held for refining and pouring. The success of the furnace depends upon a continuous, automatic circulation of the molten metal between the secondary and the melting pot, to prevent overheating in the former and to deliver the heat to the cold metal in the latter. It is in the form of the secondary, and in the character of the circulation and the method of producing it, that the new fundamental features of this furnace are found.

The secondary loop in this furnace closes upon itself without passing through the melting chamber, as illustrated by sectional views in Fig. 1. It is in the form of a hollow cylinder, of considerable length, which communicates with the melting chamber through two distinct ports or passages, from opposite ends of the cylinder. The current flows around the cylinder in a circumferential direction without entering the chamber or communicating passages, while the circulating charge flows through it in an axial direction, transverse to the current. The movement of the molten metal is unidirectional, from the secondary cylinder to the melting chamber by one passage and from that chamber back to the secondary by the other.

Enormous Force

[illegible]ion in this furnace is ef[illegible] of electromagnetic [illegible]ugh the medium of [illegible] field, which exists [illegible] secondary in any [illegible] transf[illegible]rce is proportional to the s[illegible] current flowing, and is familiar [illegible]sformer engineers as having ca[illegible]uch trouble in the wrecking of tra[illegible]rs when the windings were not held [illegible]h sufficient rigidity to withstand the enormous forces of this nature which are set up when short circuits occur.

The induction furnace is, in fact, a special case of a short circuited transformer, in which the internal impedance is comparable with the total full load impedance of the secondary circuit of the ordinary transformer. The repulsive force in this furnace, therefore, is not excessive, as in ordinary transformers when short circuited, but only such as exists in ordinary transformers when normally loaded.

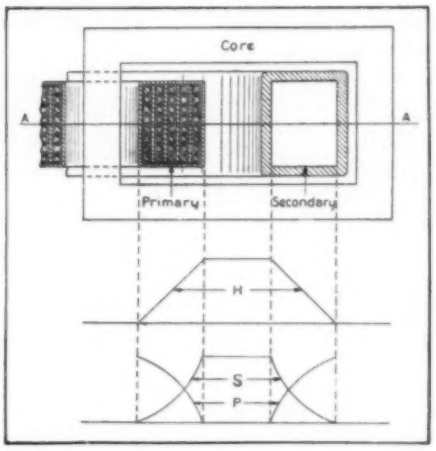


FIG. 1—TRANSVERSE SECTION THROUGH PRIMARY AND SECONDARY OF A HYPOTHETICAL FURNACE, WITH CURVES

H shows the variation of the density of the magnetic leakage field between primary and secondary along lines parallel to A-A.

S shows the variation of the stress in the field which is proportional at every point to the square of the density.

P shows the variation of the fluid pressure in the molten metal. The difference between the fluid pressures at two points is equal to the difference between the corresponding stresses of the field. The maximum fluid pressure occurs in the part of the secondary most distant from the primary where the minimum stress is found.

Some explanation may assist in understanding how this repulsive force becomes effective in producing circulation of molten material through the secondary, while the secondary itself is fixed in position.

In the case of an ordinary transformer, with solid secondary, relative motion between primary and secondary occurs only when the strength of the structure supporting the windings is not sufficient to withstand the force corresponding to the current flowing, and when such motion does occur, the current and its conducting medium, the solid metal of the coil, necessarily move together. In this furnace the case is quite different. The repulsive force will always be small, relative to the physical strength of the structure as a whole, and while the secondary current and the position of the secondary do not shift, yet the secondary conducting medium can and does flow. This difference is understood after considering the nature of the magnetic leakage field, which is the same in both cases, and the natural effect of the modified conditions upon its action.

The physical characteristics by which any magnetic field makes itself apparent are those of mechanical attraction and repulsion, and of inducing voltages in conducting media when relative motion not parallel to the field occurs between it and the conducting medium. A force of attraction exists between unlike magnetic poles, while a force of repulsion exists between like poles. The former force is due to a tractive effort or tensile stress exerted by the field in directions parallel to itself, while the latter is due to a pushing effort or compressive stress in a direction at right angles to the field. These stresses are true mechanical stresses, measurable in grams per square centimeter or pounds per square inch, which exist simultaneously in any magnetic field, and which produce the results which such stresses would be expected to produce.

Pressure Varies

The stress involved here is that of pressure at right angles to the field, this field being the leakage field between primary and secondary. In the case of the solid secondary of the ordinary transformer, if it is free to move, bodily motion will be produced. If it is properly supported, although mechanical pressure is produced, no movement occurs. In the case of the fluid secondary of the furnace, the mechanical pressure appears as a fluid pressure and even though the secondary as a whole is not free to move, this fluid pressure, if not uniform, and if permitted to do so will cause the metal to flow from points of higher pressure to points of lower pressure. It remains now to show that the

Paper presented at the general meeting of the American Electro chemical society held in Montreal. The author is engineer in the power and mining department, General Electric Co., Schenectady, N. Y.

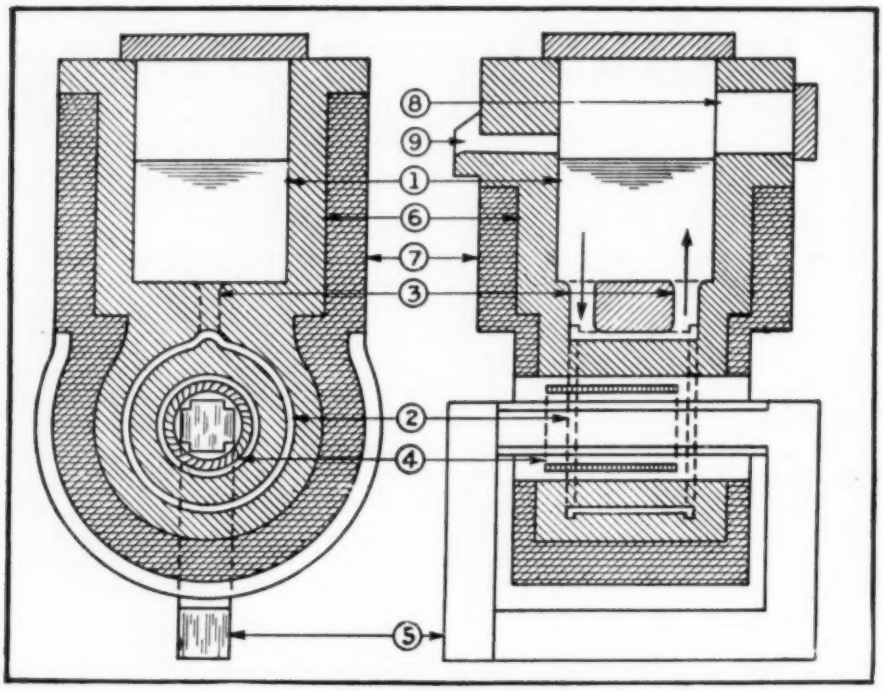


FIG. 2—TWO VERTICAL SECTIONS OF THE FURNACE AT RIGHT ANGLES TO EACH OTHER

1—Molten metal bath in melting chamber 2—Molten metal secondary cylinder in which heat is generated by induced currents 3—Ducts for unidirectional circulation of the metal 4—Primary winding 5—Laminated iron core 6—Refractory lining 7—Thermal insulation 8—Charging door 9—Pouring spout. Note the thickened sections at the ends of the secondary cylinder, one serving as a channel for distributing the metal around the perimenter of the cylinder and the other for collecting it. The flow within the main body of the cylinder is in axial direction. Note the axial displacement of the primary winding with respect to the secondary. The velocity of the circulation of the metal may be varied by shifting the position of this winding

pressure is greater at certain points in the secondary than at certain others, and to show how this pressure difference is utilized to produce the desired circulation.

The leakage flux between primary and secondary is not all confined between their adjacent boundaries. This matter has been carefully investigated for transformers, and for an arrangement with transverse cross section, such as is illustrated in Fig. 1, for instance, the distribution of the leakage field is shown by the curve, *H*, the ordinates representing the magnetic densities at points along lines parallel to *A-A*. In both primary and secondary, the density falls away gradually from its maximum value at adjacent boundaries and disappears at the further boundaries. As the stress in the field at any point is proportional to the square of the density, the variation of the stress along the line *A-A* is in accordance with the curve *S*. However, this does not signify that the mechanical or fluid pressure imparted to the secondary (or primary) is represented at each point by the ordinate of curve *S*.

Magnetic Stress Counter-balanced

Were the density of the field uniform throughout, the magnetic stress at any point would be counter-balanced by equal stresses at all other points, and no mechanical pressure would be imparted to the material medium. It is only the difference between the magnetic stresses at given points in the secondary that appears between those points as mechanical pressure.

If the differentials of pressure be added along the line *A-A*, from the side of the secondary nearest to the primary to the side farthest from it, the integrated or effective pressure will be represented by curve *P*, such that the ordinate of *P* at any point added to the ordinate of *S* equals the maximum value of *S*. The ordinate of curve *P* at any point represents a pressure difference between that point and a point at the side of the secondary nearest to the primary.

In the case of the fluid secondary found in the furnace, this pressure difference constitutes a difference of fluid pressure. It cannot equalize itself within the secondary, since it is opposed by the stresses of the field which sets it up. If, however, a passage or passages be provided external to the secondary, from the point of maximum pressure (farthest from the primary) to the point of minimum pressure, (closest to the primary), as illustrated in Fig. 3, the pressure difference will cause the fluid to flow, as indicated by the arrows.

Maintained by the Field

The pressure causing this flow will be maintained by the field, with a corresponding internal flow from the point of minimum pressure to the point of maximum pressure. The strength of flow will be such that the sum of the internal and external pressure drops due to friction will be equal to the total pressure imparted or generated by the field.

Figs. 2 and 3 illustrate in the simplest manner, the principle involved. The arrangement of primary and secondary in the furnace, as actually developed and represented in Fig. 1, differs from that in Fig. 2 and 3 for practical reasons, but

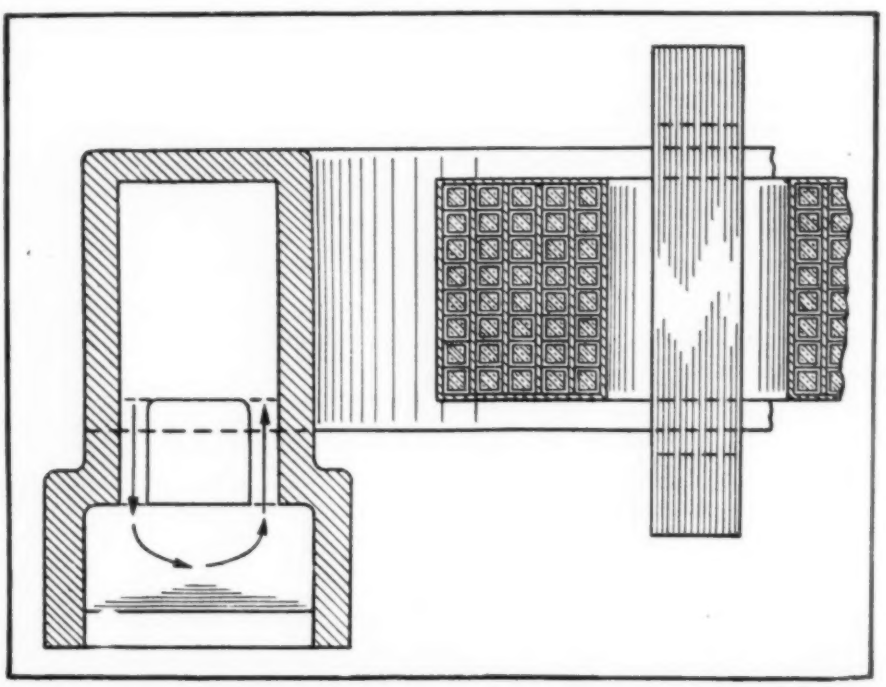


FIG. 3—SECTION OF HYPOTHETICAL FURNACE SHOWN IN FIG. 2, PERPENDICULAR TO THE SECTION IN THAT FIGURE

the principle is the same. Maximum and minimum fluid pressures are found at the ends of the secondary cylinder which are respectively farthest from and nearest to the primary winding as a whole, or to use a form of expression common with transformer designing engineers but somewhat lacking in definition, at the ends which are farthest from and nearest to the magnetic center of the primary winding. This pressure distribution results from the diagonal arrangement of the leakage field, due to the axial displacement between the primary and secondary. It is the radial component of this field which generates the pressure difference between the two ends of the cylinder.

That the axial forces set up in such an arrangement are substantial realities, has been demonstrated by experience in transformers with windings of the concentric cylindrical type. Comparatively small axial displacements of these windings have, upon numerous occasions, resulted in crushing the mechanical supports of the coils and deforming the coils themselves, the primary being driven in one direction against the yoke of the core, and the secondary in the other. The differences in fluid pressure between the two ends of the secondary cylinder in the furnace are demonstrated by the flow of the molten metal in the furnace. Any reasonable velocity of the circulation can be easily obtained, by merely adjusting the axial position of the primary winding with respect to the secondary, for which provision is made in the mechanical design of the furnace.

As intimated at the beginning of this paper, the chief significance of the new physical features which have been described lies in their effects upon flexibility of design and scope of application. The free unidirectional circulation, set up by a force which can be controlled within desirable limits, not only restricts the temperature variation of the metal to a small value, but also avoids the danger of magnetic choking.

This makes it practicable to force the furnace to any extent which is feasible for the primary winding and core, and particularly adapts it for the melting of high conductivity metals, such as copper, as well as of metals of lower conductivity. The form of the secondary is favorable to flexibility of design as regards size and capacity. The only limiting feature in this direction consists in the refractory lining, due to considerations of mechanical strength and general reliability. Such limits are probably capable of indefinite expansion. Increased size and capacity will have no necessary effect upon the power factor, which is inherently high with the long thin section of the secondary. The lining is the only limiting factor.

How and Why in Brass Founding

By Charles Vickers

Alloy of Nickel-Bronze Melted in Cupola

Is there any possible way of melting a nickel-bronze in a cupola, in half-ton lots? Our formula consists of copper, 82 per cent; nickel 6.5 per cent; tin, 10 per cent; aluminum 1.5 per cent.

The cupola will melt the alloy but the problem is to get sound castings after the melting is done. As the alloy contains 1.5 per cent aluminum we presume it is possible to make sound castings from cupola melted metal. However, this is only a guess for never have we seen it tried.

The nickel should be added in the shape of a 50-50 copper nickel alloy, and the tin and the aluminum should be added to the molten copper and nickel alloy after it is tapped from the cupola into a ladle. The latter should be hot, and after the copper is tapped, charcoal should be scattered over its surface. Melt the tin and the aluminum together in the proper proportions previous to the time the alloy is to be used and run it into small ingots which can be added to the molten copper-nickel alloy in the ladle. In addition to the aluminum which will act as a deoxidizer, it would do no harm to add about ⅛-pound manganese copper for each 100 pounds copper tapped from the cupola. Place the manganese copper in the bottom of the heated ladle, and tap the copper onto it, then add charcoal and the tin-aluminum alloy. The object of first alloying the tin and aluminum is to increase the specific gravity of the aluminum. If added in the metallic shape it probably would float on top of the copper, or in the upper layer, and be difficult to get properly mixed. After the addition of the white metals, it will be necessary to employ some stirring arrangement. Should there be any difficulty about stirring the metal, tap the copper onto the tin-aluminum alloy.

High Temperature Causes Aluminum Trouble

We are making small but massive aluminum castings of an alloy of copper 14 per cent; aluminum 86 per cent, but are unable to obtain them free of small holes which show like little specks after the castings are machined. A sample casting is forwarded for your inspection, and we will appreciate any suggestions you may be able to offer as to the cause of these holes. The sample was poured at 1400 degrees, Fahr., but we have poured at 800, 900 and 1000 degrees and have experienced the same trouble.

Usually the difficulty experienced in the case of these castings is caused by pouring the alloy into the molds at too high a temperature. For the castings in question a pouring temperature of 1400 degrees is too high. As the melting point of commercial pure aluminum is 1157 degrees Fahr., we are unable to understand how the alloy could have been poured at 800, 900 or 1000 degrees, unless two thermometer scales are being used, the Fahrenheit for the 1400 degrees and the Centigrade for the 800, 900 and 1000 degrees.

Otherwise we incline to the belief the temperature is being judged without the aid of a pyrometer, or if one is used it requires calibrating. To overcome the difficulty, pour the metal at as low a temperature as possible, and in the case of the castings in question, that will be around 1256 degrees Fahr., by pyrometer. If the casting temperatures are being judged by the eye, pour the metal when it appears silvery by ordinary daylight, and slightly red in the gloom.

Give the aluminum alloy careful attention during the time it is melting. Keep the metal just under fusion until the pot is filled, then superheat to a dark red in the furnace, which will give time to get the metal to the molds at the proper pouring temperature. Nothing else can be done, but careful attention to the foregoing details will overcome the difficulty.

Small Amount Aluminum Causes Pitting

We are casting an alloy of 65 per cent copper, 30.42 per cent zinc, 2.81 per cent lead, and 0.41 per cent tin into small castings using a squeezer machine and plated patterns. We are sending

you a sample casting from which you will note a number of pit holes on the unfinished sides of the casting. When machined the metal is sound, but the pits on the unfinished portion spoil the appearance of the work. A good class of pig metal is melted in a non-crucible oil-fired furnace.

We are unable to decide from an inspection of the casting whether the pits are caused by sand washed from the mold, or if they are due to a *draw*. We note that one of the green sand cores forming the depression in the casting has *washed* off at one side to an extent that would provide loose molding sand sufficient to cause the pits, but of course, this might have been broken in lifting the cope and never repaired. The trouble with the casting is that it has been finished and looks as though it had been dipped. This process would remove evidences of aluminum in the metal which would be visible in an undipped casting. If the casting has not been dipped, then the metal contains aluminum, if it has been dipped, we suspect the presence of aluminum, because this element will cause just the eruption exhibited by the casting.

An alloy of the composition given will run without aluminum, and if this latter metal is omitted, there will be no pits, such as shown. To provide against the sand washing, add a considerable amount of molding sand to the piles and make further additions every week. Also the runner should be arranged mostly in the cope and should out-top the castings to feed them and avoid shrinkage.

Metal Is Poured Too Cold in a Dirty Mold

We are having trouble getting sound bronze castings of the following composition: copper 85 per cent; zinc 5 per cent; tin 6 per cent and lead 4 per cent. That you may better understand the trouble we are sending you a sample casting. You will see numerous fissures or small holes, possibly blow holes and the casting is not at all smooth. We add 4 ounces of phosphor tin per 100 pounds of metal and we use about 25 per cent gates; melt in pit crucible furnace with anthracite coal and lift the crucible when the metal has attained a temperature of 1920 degrees Fahr. The metal then is ingoted and remelted for the castings. Charcoal is sprinkled on the metal in the crucible to protect it from the air. Immediately after skimming a dross forms on the surface of the metal.

Judging the casting from its surface appearance and from the green colored specks appearing here and there we would say that the metal has been poured at too low a temperature. The rough places are caused by the washing and collecting of some dust-like incombustible substance that is either used in powdered form on the mold, parting or some kind of facing, or, they may come from powdered charcoal on the surface of the metal. In making the molds, blow the parting material from the patterns, then dust slightly and when finishing the mold, dust over with flour and blow off. Have the metal bright looking and lively and pour the molds rapidly. Instead of the charcoal that is put on top of the metal, scatter about an ounce of powdered phosphor-copper or shotted phosphor-copper on the surface and rabble it about with the skimmer, then keep the dross back when pouring the metal.

Scrap Aluminum Presents Melting Hazard

We are having difficulty in making bushings and sticks of aluminum alloys, 7 per cent copper and 93 per cent aluminum in the form of clippings. The castings when machined show holes under the surface; some small and irregularly shaped, others larger and surounded by what looks like dross. We melt in gas fired crucible furnaces and the metal is clean. We add the copper to the aluminum clippings in the shape of a 50-50 copper aluminum hardener.

The difficulty appears to be due to excessive oxide in the metal which deposits along the boundaries of the crystals and tears out under the tool, thus producing the irregularly shaped holes faintly discernable on the surface of the sample casting forwarded for inspection. Some of the crystals close to the surface are cut in half by the tool and the embedded halves are torn out by the tool, leaving the cone shaped pits. The oxide acts as a parting so that the cut crystals are not held firmly. It appears to us that the use of scrap is not justified by the results obtained. We should suggest you leave the scrap to be melted and put into commercial shape by smelterless equipped to run it down with a minimum of oxidation. Apparently this scrap material is costing you more than new ingot metal. The surface of each little piece of sheet scrap is covered with oxide and even with the most careful melting the castings will be produced under a great handicap. There is a possibility that the difficulty would be remedied by substituting 50 per cent scrap with new ingot, melting the ingot first and then dissolving the sheet metal scrap in the molten new metal.

Leaded Alloys Not Always Acid Resisting

We shall appreciate a formula for an acid resisting metal that will contain as much lead as possible. The castings are to be threaded and must withstand a great strain. We have tested four different alloys with poor results. One of these alloys contained copper 74 pounds; lead 15 pounds; tin 8 pounds and zinc 1½ pounds.

There is no such thing as an acid resisting nonferrous metal alloy although some alloys will resist certain acid solutions better than others. Thus an alloy with a high nickel content will resist a solution of sulphuric acid better than a copper-tin alloy, but in a solution of hydrocloric acid the expensive high nickel content alloy is inferior to the ordinary red brass used for radiator valves. It also is a mistake to imagine that a highly leaded alloy will be a good acid resisting metal. The lead is only held in suspension in the alloy and therefore a leaded alloy will not resist any acid solution that will attack lead. It is stated the castings are subjected to great strain, but a leaded alloy is wanted because they must be acid resisting. Even if we admit that highly leaded alloys would resist this particular acid solution—particulars not given—the fact that the castings must be strong makes it necessary to keep the lead content low. As the castings are to be threaded some lead will be necessary and in our opinion the following alloy will be found satisfactory:

Acid Resisting Metal

	Per cent
Copper	88
50-50 Nickel copper alloy	2
Tin	6.50
Zinc	2.00
Lead	1.50

White Metal Alloy Will Resist Oxidation

We have an inquiry for a cast metal plate to stand weather and not tarnish. We do not know whether some of the white metals are suitable or not. Will you kindly let us have your suggestions.

We know of no alloy outside the precious metals that will maintain a polished surface indefinitely when exposed to atmospheric influence. Probably the simplest way of getting around the difficulty would be to cast a plate in good red brass, polish the high lights and then nickel plate the surface. This will maintain its polished white color for a considerable time and afterward the color may be restored by wiping the suface with a dilute solution of phosphoric acid. If a solid white alloy is wanted the following will withstand atmospheric oxidation for some time, but not indefinitely: Copper 67.25 per cent; nickel 30 per cent; aluminum 2.75 per cent. Melt the copper and nickel together under charcoal, or, preferably use an alloy of 50 per cent copper, 50 per cent nickel to alloy the nickel content. The aluminum is added last.

Foundry Problems Discussed

Specifications for Pig Iron, Prevention of Embrittlement of Malleable by Galvanizing, Sulphur in Coke and Treatment of Steel Considered at Meeting of Mining and Metallurgical Engineers

ADOPTION of the tentative specifications for foundry pig irons, as proposed by the American Society for Testing Materials, was urged at the meeting of the American Institute of Mining and Metallurgical Engineers, held in New York, Feb. 19-22. In discussing these tentative specifications Dr. Richard Moldenke, Watchung, N. J., stated that the requirements in the specifications were compiled so as to leave the foundryman absolutely free in the selection of what he wants, merely safeguarding the methods by which he may make known what he gets, as well as protecting the furnaceman in his proper shipments. Specifications for a special line of castings should be definite in fixing the physical characteristics of the material covered, he said, but liberal in the ways and means of producing it.

Dr. Moldenke stated that he believes the idea of standardizing the composition of lines of castings is not a bad one, provided these compositions do not become part of the specifications required. Conditions of practice, he added, have a considerable effect upon the mixtures that can be successfully run through a cupola or furnace. He pointed out that the presence of comparatively thin ribs in castings of otherwise heavy sections means a mixture different from that used where these ribs were absent. The commercial necessity of higher scrap ratios, the use of much steel scrap for especially high grade work, mean when all combined, a wide variation in composition requirements, which militate against standard analyses. He said he felt that it was wise to include the compositions wanted, with sufficiently wide limitations for fairness and yet close enough to insure the result, as "recommended practice" rather than a definite specification requirement. Later, it was suggested by Dr. Burgess that forms of recommended practices be compiled, to serve as an appendix to the specifications.

Recommended Practice

Dr. Moldenke said this would put it up to the foundryman to be sure of his ground before deliberately deviating from what is recommended and upon what he has been supposed to bid. In the case of eventual trouble and rejections of work, the foundryman has nothing to stand upon if he has used his own judgment, as against the crystallized thought embodied in generally accepted standards, the speaker added.

Offers Solution

On the other hand, he stated, there is no reason why one or more of the elements in cast iron should not be particularly specified in the fixed requirements, if these elements are of vital consequence. He cited the example of sulphur in cast iron pipe. The introduction of the maximum limit of sulphur in one case, phosphorus in another and copper in still another does not mean, however, that the full composition should be specified, for, in so doing Dr. Moldenke said, the purchaser is in realiy taking over the responsibility for the final result. The present tendency of adding chemical requirements to the usual physical requirements is strongly to be deprecated. He declared that the selection of the right composition for a given casting is not the cure-all of the situation, but is merely a safe starting point. It was brought out in the discussion that the specifications are not applicable to steel castings, but that a committee is at work on the problem.

W. Wood, Philadelphia, expressed the opinion that the specifications are exceptionally good, if not almost final, and urged that they be adopted. If closer specifications are desired, it should be a matter of personal negotiation, he said. Incidentally, Dr. Moldenke, in touching on the subject of sulphur in iron, said that a foreign process of desulphurization has been meeting with considerable success, and will undoubtedly show itself in this country within the next six months.

A solution for the problem of deterioration of malleable in galvanizing was advanced in a paper presented by W. R. Bean, the Eastern Malleable Iron Co., Naugatuck, Conn. The embrittlement of malleable in the process of galvanizing, he said, is intimately connected with the phosphorus and silicon contents of the iron. Low phosphorus and low silicon irons, under 0.15 and 0.80 per cent, respectively, will withstand the process best and show little or no deterioration. With phosphorus contents of the order of 0.10 per cent considerable liberty may be taken with the silicon which may go as high as 1.30 per cent without serious trouble from galvanizing, he added.

Experimentation has proved that in those irons, which are embrittled, the deterioration by the galvanizing is due to a thermal effect resulting from the quenching after the galvanizing operation. However, the exact mechanism of the deterioration, that is whether it is a form of internal strain or a segregation of the silicon and phosphorus in some way at the grain boundaries or some other factor or factors, is not as yet known.

Microphotographs were displayed, which demonstrated that fracture in the defective galvanized material is intergranular, an abnormal condition, while fracture in ungalvanized material is transgranular, a condition common to nearly all metals at normal temperatures. In other words, the brittleness of such malleables as deteriorate in galvanizing is due to intergranular weakness.

Three distinct methods of avoiding galvanizing embrittlement have been developed, Mr. Bean stated. One was by manipulation of the phosphorus and silicon; another by the use of high temperature quenching baths after galvanizing; and the third by eliminating quenching entirely. The first, he believed, was the most practical, as it could be carried out in a foundry and did not involve a modification of the galvanizing process itself.

Annealing a Factor

Mr. Bean declared that since the preparation of the paper a further study of the problem indicates that annealing is a factor affecting, slightly, at least the character of the fracture produced. Shock tests were made on 112 duplicate specimens from as many different foundry heats, annealed under different annealing cycles. As a ready guide to foundrymen in determining whether or not a given iron is fit for galvanizing, a working curve was presented between desirable and undesirable irons insofar as silicon and phosphorus contents are concerned. But the further experimentation above mentioned caused Mr. Bean to advise all foundrymen to keep to the left of the curve by 0.04 per cent phosphorus. Mr. Bean stated that while he and his associates did not include cupola malleable in the tests, he

believed that the results would be practically the same.

Forms of sulphur in coke and their relations to blast furnace reactions were presented in a paper by Alfred R. Powell. He pointed out that while sulphur always has been a troublesome element in iron smelting, the problem will become of increasing importance as the higher sulphur coke is used, because of the rapidly diminishing supply of low sulphur coals. Rather than discuss the slagging conditions that promote the sulphurization, which he felt was fairly well understood, he placed emphasis on the conditions under which the sulphur enters the iron, and added that he proposed to make a further study which would deal with the factors involved in the entry of the sulphur into the iron.

Coke, he said, contains four characteristic constituents; namely, ferrous sulphide, absorbed free sulphur, sulphates, and sulphur held in solid solution in the carbon. Mr. Powell stated that the reduction zone of the blast furnace, the free sulphur and the sulphates in the coke are reduced to ferrous sulphide. In the zone of spongy iron, a considerable amount of sulphur is taken up by the iron from the coke. The ferrous sulphide constituent of the coke at this point is in the form that gives up sulphur. In the slagging and combustion zone the iron that was contaminated in the upper part of the furnace is desulphurized by the slag.

Clean Iron

Until a systematic study is made of the methods the colloid chemist can suggest in obtaining clean steel, the surface of this problem has scarcely been scratched, according to H. W. Gillett. So far, he said, there is only one relatively satisfactory method in use, that being a final quiet period in electric or crucible furnace, and that this was not infallible. He defined dirt in molten metal as an emulsion or suspension of colloidal nature, and quoted Prof. W. D. Bancroft, Cornell university, as to several methods by which the colloid chemist might attack the problem. One was that it might be possible to clean the metal from sonims by introducing more sonims of larger size, because of the greater tendency to agglomeration: another, the possibility of absorbing the sonims into other materials. Still another is increasing coalescence by making the sonims more fusible. The cleaning action of titanium and vanadium in steel was suggested as possibly having a specific coagulating effect on the sonims, enlarging them above the critical size so they will rise.

E. P. Mathewson, consulting engineer, New York, was elected president of the institute, succeeding Col. Arthur S. Dwight, also of that city. T. T. Brewster, vice president of the Mount Olive & Staunton Coal Co., St. Louis, and Frank M. Smith, director of the Bunker Hill smelter, Spokane, Wash., were elected vice presidents, succeeding Frederick Laist and Seeley W. Mudd. These officers, along with the following members, will serve on the directorate for the ensuing year: A. N. Diehl, general superintendent of the Carnegie Steel Co., Duquesne, Pa.; Reno H. Sales, geologist, Anaconda Copper Mining Co., Butte, Mont.; Seelley W. Mudd, Los Angeles, Cal.; G. H. Clevenger, consulting metallurgist, United States Smelting, Refining & Mining Co., Boston; and W. H. Aldridge, president the Texas Gulf Sulphur Co., New York. The latter three were re-elected.

Fine Sand Suitable if Properly Vented

Question—We have just started a foundry in which the cupola is lined to 25 inches. The blast is furnished by a No. 6 Buffalo Forge Co. fan, recommended to run at 3500 revolutions a minute but which we have coupled to a heavy duty oil engine, variable speed, that will give us up to 4250 revolutions per minute, or about 11 or 12 ounces. The blast passes through an 8-inch pipe and enters the cupola through two 2½ x 7-inch openings. On our first heat we lost 25 per cent of the castings on account of blows from the new sand, and on the second heat we lost 10 per cent on account of cold iron at the beginning of the heat. We are enclosing illustration of the casting and also forwarding a sample of our sand. All the holes in the casting are cored with the exception of a ½-inch hole in the side which is drilled. We use all scrap for the charge, including a considerable quantity of good machine scrap on account of the drilling operation. We used from 7 to 10 per cent steel last season, and while the castings seemed harder and tougher they also appear to be subject to blow holes. Would you advise the use of pig iron and to what extent? We understand that there is a process for using up to 40 per cent steel which would be an advantage to us if we could get away with it. What amount of steel and limestone would you suggest and what is the chemical action of the limestone? Would you advise using beach sand or sea coal to open up our new sand and in what proportion?

Answer—The sample of sand submitted apparently should produce satisfactory castings. It is rather fine and therefore should be handled fairly dry and not rammed too hard. The pocket in the knuckle should be vented freely to prevent the casting from blowing. The use of beach sand or sea coal would have a tendency to open up the sand, but judging from the sample submitted we are of the opinion that the use of neither one is necessary. If you are cleaning the castings by hand the addition of 1 part of sea coal to 10 parts of sand will be found beneficial since it will have a tendency to produce a cleaner skin, but if you are tumbling the castings in a mill its use is not necessary. We see no valid reason why you cannot core the two ½-inch holes in the sides as readily as any of the other holes. It is a cheaper method than drilling and besides if your iron is on the hard side it will make no difference.

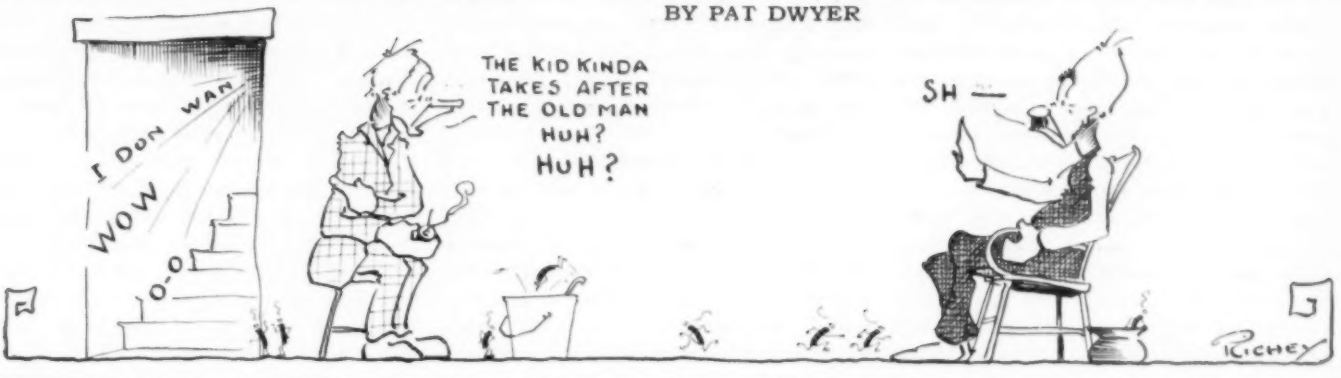
Your indicated blast pressure is too high and under ordinary circumstances will cause hard and oxidized iron. From 8 to 10 ounces pressure is high enough for a small cupola. You would secure more uniform melting conditions by providing four, instead of two, tuyere openings 2½ x 7 inches. The limestone melts and unites with the coke ash to form a liquid slag which may be drawn off from time to time, thus leaving the cupola clean. Usually the amount of slag produced in a cupola running on a small heat will not affect its efficiency. However, if on account of using an excess of dirty scrap, the cupola shows a tendency to bridge during the progress of the heat, or if it is difficult to chip it out on the following morning, you may use a shovelfull of limestone on each charge with beneficial results. In your case we should recommend making up your charge in 300-pound lots of iron with about 50 pounds of coke under each charge. The coke bed should extend approximately 24 inches above the tuyeres just before the iron is charged. From 7 to 10 per cent steel scrap probably is the maximum amount you can carry with an all-scrap charge. Your castings will need to show at least 1.50 per cent silicon and the amount of steel scrap used, which has no silicon, will depend on the silicon content of the remainder of the charge.

Plan Two Day Meeting

Two days technical sessions and an exhibition of foundry equipment and supplies are planned by the Wisconsin Foundrymen's association for its annual meeting in Madison, Wis., April 4 and 5. The program will include the discussion of practical foundry problems and a consideration of questions of economic and political importance. The stock judging pavilion of the state university has been secured to provide space for the exhibition. It is the intention at this meeting to form a permanent state organization and to establish a research department, for which the University of Wisconsin has offered the use of its laboratories. William J. Grede, Liberty Foundry Co., Wauwatosa, Wis., is president of the association.

Bill Makes Column Bases In Green Sand--II

BY PAT DWYER



BELCHING clouds of highly odoriferous tobacco smoke from a new and shiny corn cob pipe, Bill drifted into our modest cot one night recently. He removed the pipe temporarily and cautiously inquired if the Missus was home. With the true spirit of hospitality which recks not of consequences and blissfully allows the future to take care of itself I told him that the lady was engaged upstairs in trying to solve one of the oldest problems of the human race, viz: presuading a little cherub to shut her eyes and go to sleep. From experience gained through personal contact with a fairly long line of similar cherubs I felt reasonably sure that we should not be disturbed for at least half an hour and, therefore, I assured Bill he was quite safe in contaminating the atmosphere to his heart's content.

"I trust," I said to Bill, "that I am not unduly inquisitive. Far be it from me to comment adversely or otherwise on the rotten taste you display occasionally in your selection of smoking tobacco, but as one professional smoker to another would you mind telling me where you picked up that sacrilegious apology for the divine weed?"

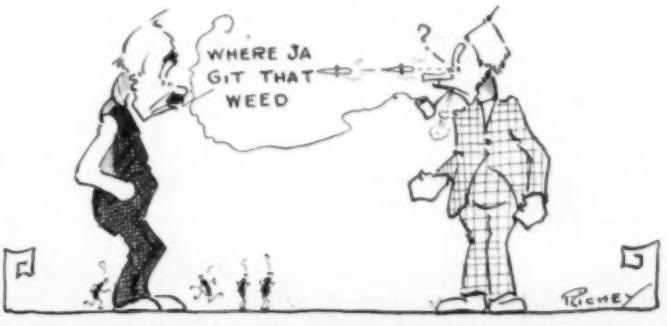
"Not at all," said Bill. "Not at all, I did not pick it up. It was wished on me one day last week down in li'l ol' N'Yawk. I met a fellow who thinks that smoking is a kind of religion to be practiced with due pomp and ceremony and with the most punctilious regard for every little detail. He views with just the proper mixture of disdain and amused toleration those poor benighted characters who smoke ready made cigarets and cigars. The sight or smell of the humble stogie induces a positive feeling of naseau. If he unfortunately passes to leeward of an honest artisan puffing contentedly on a clay pipe he feels it incumbent on his part to hasten to his apartments for a perfumed bath and a complete change of raiment. He is some kid.

"With all the zeal of your true proselytizer he begged me to accompany him to the only real Mecca in New York where the faithful were served in a proper manner. At one time or another probably I have smoked as many brands of tobacco as the next man, ranging all the way from the dainty stuff wrapped in tin foil up or down, depending on the point of view, to the old reliable black stuff made in Montreal guaranteed to curl the hair on a neophyte. On occasion I have even smoked cigars, but the practice presents so many difficulties that I never became more than fairly proficient. The orginal owners smoke them so short that the labor involved in collecting even a modest supply is excessive. The careless manner in which they are thrown in the gutter is nothing short of criminal and only is matched by the culpable negligence of those who deliberately cast them on the sidewalk, there to be almost ruined under the heels of the proletariat.

"I wish you could see the joint into which I was enticed by this epicure. The door was guarded by a huge creature attired in the brilliant garments affected by the dandies of a hundred years ago; jeweled shoe buckles, silken knee breeches, flowered waistcoats, demme; half a yard of lace, begad, hanging from each sleeve and another half yard around the neck. Why any human being should be willing to make an animated monkey-on-a-stick of himself in that manner is beyond me, but the poor benighted goat was either proud of himself and his position or else he was an exceptionally clever actor. He threw the door open and bowed us in with as much ceremony as if we were a belted earl. I never have seen a real earl alive and on the hoof, but in a general way I have gathered that the real ones, the belted ones, are objects of mild adoration in their native land, hence the comparison in the present instance.

The interior of the store was furnished and upholstered in keeping with the impressive entrance and the discreet, elderly gentlemen in attendance were garbed becomingly in dark frock coats, gray trousers and immaculate white spats. They did not calmly ignore a customer, or wait patiently until the customer made his wants known and then throw him a paper of tobacco and snap the money after the fashion of some young high-binders with whom I have had dealings—once.

"One of the pieces of animated wax work came forward to meet us and having gently, decorously and solemnly announced that it was a beautiful day, inquired in what manner he might be privileged to assist us. The clerical garments, the precise articulations and the general cathedral air of the place began to exercise an uncanny influence on me. My reason told me that I was in the presence of men in a store that perhaps is more distinctively masculine than any other and yet I instinctively felt that I should remove my hat. I noted that my guide retained his on his head so I assumed as nonchalant an air as possible



TOBACCO SMELLS THE SAME IN EVERY LANGUAGE

under the circumstances and did likewise.

"Old Spats politely professed to be mildly surprised when I admitted that I never had found an ideal tobacco. With few exceptions all tobacco is good and will serve for a smoke. He claimed that I was mistaken and if I kindly could spare him a few minutes of my time he would prove his contention, he hoped to my pleasure and satisfaction. Would I mind stepping this way and sitting down? I wouldn't and I did.

"He led me to a little round revolving table and disclosed in it probably 100 little pockets each with a separate lid and filled with tobacco, the contents in each pocket differing from that in any other. I admitted that I liked mine fairly strong and with that information for a guide the tobacco man suggested that I take a puff or two from various mixtures which he selected. Just to be obliging I pulled an old corn cob pipe out of my pocket and nearly broke up the party. Nothing but the most heroic restraint on the part of the old boy prevented him from calling Marry-come-up in knee breeches from the front door to run his rapier through under my wish bone and then perhaps wipe it on the tail of my coat.

"He declared that my pipe was a menace to the community and furthermore that really it did not matter whether I smoked tobacco or the scrap shavings from a horn and hoof factory. The smell would be the same in both cases. He showed me an elaborate display of pipes ranging in price from $15 to $500 and suggested that I select one or, better still, a set, in which to carry on the experiments.

"In my young and silly days while I was content to smoke the humble cob or clay pipe during working hours, I have paid as high as $2 for a genuine French briar, made in Grand Rapids, to be smoked while attending social functions and on other occasions where I was temporarily a man of leisure. Since arriving at the age of reason, a date that seems to synchronise with another date on which a certain fair maid said "Yes" or "I guess so"—I was so excited that really I have forgotten the exact terms employed; in fact I am not prepared to swear that she said anything. Well, anyway, since that time I have bought no more fancy pipes.

"The old Boy's suggestion did not appeal to me, but I did not like to hurt his feelings, so I told him I came from the corn belt in the Middle West and belonged to a secret society oath bound to smoke nothing but a corn cob pipe. He gracefully acknowledged the validity of my objection but begged, if I must smoke a cob, to please smoke a new one. He even sent a liveried footman out to one of the common stores around the corner to buy one for me and then spent half an hour trying to blend a mixture that met with my approval. He finally hit on a combination that seemed familiar and told me if I would leave my address he would send me a sample package and that it would

OUR HERO PROFFERS THE PIPE OF PEACE

cost me on the basis of $11 per pound."

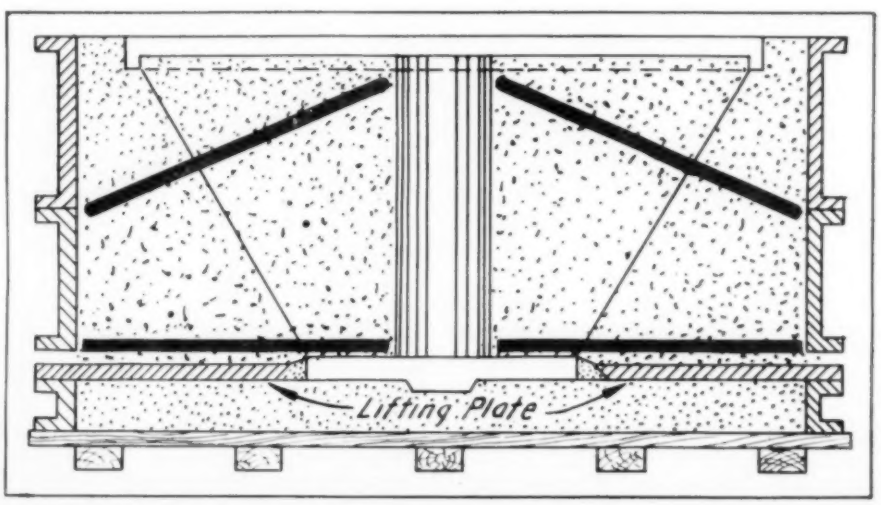
"I guess you mean per bushel, don't you?" I said. "No person ever heard of $11 tobacco."

"Well," said Bill. "I'll tell you. I never heard of it before and I am sure I never want to hear of it again. I can go down to the corner and get a package containing 1¾ ounces of tobacco for a dime, which works out at the rate of 82½ cents a pound that is good enough for any man. However, some people never are satisfied with a plain article. They want it with trimmings. The fact that they are trimmed in the process seems to make little difference. You can find instances in the foundry business. Many methods are available for making column bases, depending on circumstances and yet it is not unusual to find foundrymen sticking to one method when a little investigation would reveal a method better adapted to their particular requirements.

"In the second method of making column bases in green sand, the sand forming the pockets may be supported by a number of chuck bars attached to the cheek, or by a suitable lifting plate either attached to the lower edge of the cheek or provided with handles to which the crane chains may be attached. From the foregoing it is apparent that the mold is made in a 3-part flask, if made in the orthodox manner. However, as previously stated, if the customer is willing to accept a casting poured in an open sand mold, the flask parts may be reduced by omitting the cope. If conditions are favorable to bedding the small flange in the floor, no drag will be required and it only will be necessary to provide a lifting plate and cheek flask.

"Where the pattern is molded in a 3-part flask it may be rolled over or *bedded in*. The bedding-in process is the simpler of the two if a man is familiar with it, but since the rolling over method is practiced exclusively in many foundries, a word or two on that method may not be out of place before considering details in connection with the other method advocated.

"The method adopted for ramming the drag is the same as that described in the March 1 issue of THE FOUNDRY with the exception that the drag in this instance is destined to serve as a cheek. After the sand has been rammed to the top of the brackets



SECTION ACROSS CENTER OF DRAG MOLD WITH PATTERN REMOVED

and, of course, at the same time, to the upper edge of the flask, it is scraped off approximately ¼-inch above the joint line and then the lifting plate is lowered on and rapped down to a good bearing. The plate is lifted off temporarily, vent channels are cut in the exposed sand surface and a vent wire is employed to vent the pockets thoroughly. The plate then is returned to place followed by the small base pattern. The square opening in the lifting plate is tapered so that it readily may be lifted away when the time comes to take the mold apart. A drag is placed on the plate, filled with sand and rammed. Then a bottom board or plate is added, after which the various parts of the mold are clamped together and rolled over. It will be noted in this instance that the small base pattern is *not* removed before the flask is rolled over and, therefore, it is immaterial whether the cope is rammed directly on the drag or on a board.

"The amount of crane handling is reduced where the pattern is bedded in and, besides, there is less danger of distortion since the mold is not moved from its original bed. If this method is adopted, three flask sections will be required, a comparatively shallow drag, a cheek flask, preferably one inch or more less in height than the pattern and a plain shallow cope. The reason for wanting a cheek less in height than the pattern is because a vent passage is required between the lower edge of the cheek and the plate. This passage is secured by inserting a few wedges or blocks between the cheek and the plate. By taking advantage of this feature, any flask within reasonable limits may be adapted for a cheek. The blocks may vary in height or thickness from ¼-inch to 6 inches.

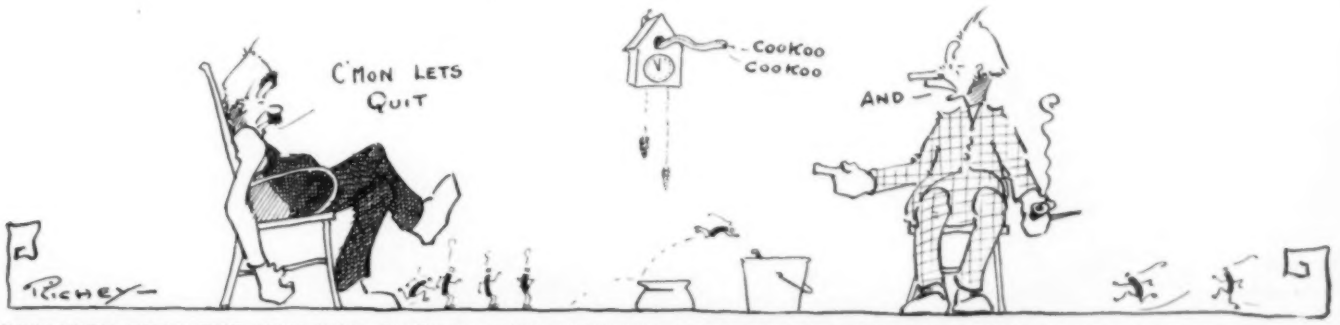
"The drag is placed on the board or plate, filled with sand, rammed and scraped off flush with the top edge. A space in the center is prepared for the reception of the small base. It is vented all over, first vertically and then by inserting the wire between the bottom plate and the lower edge of the flask. The face of the mold is smoothed over and the base pattern is placed in position either to one side or in the center, depending on the style of gate to be employed. The lifting plate is lowered and rapped into place and then the space between the pattern and the edges of the plate opening is filled with sand, rammed and reinforced with a row of nails and then slicked off to form a parting flush with the top of the pattern and the corresponding surface of the lifting plate. A little adjustment may be required in the event that the lifting plate is not the same thickness as the small base pattern, but that is a detail that may be attended to easily.

"The large pattern base with ribs attached is set in place on the small base and then the cheek flask is placed in position. Blocks of a suitable height are placed between the lower edge of the cheek and the lifting plate to bring the upper edge of the flask flush with the upper surface of the large base. A straight edge resting on the pattern and extending beyond the cheek on two sides serves as a guide in wedging the flask up to the correct height. It is not really essential to the success of the job that the edge of the flask should come in an exact line with the face of the pattern, the height may be approximated roughly with the eye, but the little time required to set a straight edge in place and block the flask up in a true and workmanlike manner does not amount to anything and a nice symmetrical looking job is pleasing to the eye and to a certain extent is an indication that a man knows his business.

"Facing sand is spread over the face of the small base between the brackets and a thickness of black sand is spread over the face of the lifting plate. Two long rods are placed horizontally in each pocket with the inner ends almost touching the pattern and the outer ends extending to the walls of the flask. It is not necessary in all cases that the rods should extend to the wall of the flask. The purpose of the rods is to support the body of sand forming the pockets after the lower base pattern has been removed and for that reason it is apparent that the part of the rod serving as the anchor must at least be a little longer than the part supporting the overhang. The factor of safety also must be considered and, therefore, while theoretically two loads of sand supported on equal halves of the same rod will balance each other it is considered good working practice to allow a generous margin on the anchored end. Usually the flask employed is a neat fit for the pattern and, therefore, rods extending to the walls are none too long to serve their intended purpose. In fact in some instances it may be necessary to turn a toe on the end of each rod or fasten a cleat above it in some manner to help carry the load.

"Spikes with the heads dipped in claywash or paste are placed upright in the corners where the brackets join the center of the pattern. Additional spikes, or, in some cases, shorter nails, are stood up in rows along the angle where each bracket touches the small base pattern. These various reinforcements are covered with facing sand and tucked and then a course of black sand is shoveled into the flask and rammed firmly. Rods are laid longitudinally and transversely on this course of sand and then additional courses of sand are rammed and treated in the same manner until the pattern with the exception of the upper face, is completely enclosed.

"Where the pattern is designed to be molded in the foregoing manner the top is left almost completely open to facilitate tucking the sand on top of the pockets. The open space is filled temporarily with black sand and slicked off to form a flat surface on which to ram the cope. Where a considerable number of castings are required several pieces of board the



RESOLVED THAT THE MAN WHO DOES NOT KNOW WHEN TO STOP IS A GREATER MENACE THAN THE MAN WHO DOES NOT KNOW WHEN TO BEGIN

correct shape and thickness are employed to fill the open space temporarily. They save time and produce a better cope surface. Where the cope is rammed on a separate board, this detail does not apply and, of course, the same holds in the event that the mold is poured without any cope.

"The plain flat cope is rammed and lifted off and then the sand surrounding the pattern is thoroughly vented, first by inserting the vent wire all over the exposed surface in the open top and then by driving a row of horizontal vents from the top and bottom edges of the cheek. The mold face of the large base is finished, including the filleting of the pockets, then the skeleton top with brackets attached is drawn out of the sand. The cheek with lifting plate then is removed and any necessary repairs effected to the lower face of the pockets. The small base pattern is taken out of the drag and then the mold is reassembled and poured."

"If it is all the same to you, Bill," I said, "let us go one step further and assume that the casting is shaken out and the flask piled up out of the way. I am inclined to punch the clock and call it a day."

"All right," said Bill, "Punch away, but beware of the fate of that bird in one of Mark Twain's stories who got tangled up in the rhyme about a pink trip slip for a 3-cent fare and who ended up in a bug house by entreating every person he met to: 'Punch, conductor, punch with care; punch in the presence of the passengaire.'"

Repairs Do Not Conform To Blueprints

BY M. E. DUGGAN

WHERE time is not a factor a patternmaker is justified in following closely every curve and fillet and every refinement indicated on the blueprint. This particularly is true where the resulting pattern is to be used for a large production. However, when a broken part needs replacement in the shortest possible time he also is justified in omitting many of the little refinements and time consumers and should confine his efforts to producing a serviceable pattern, one that can be converted into a casting with the least delay.

The accompanying illustration, showing a broken section of a journal box and cap is a case in point. A new pattern for the box was required and that involved the preparation of two half rings *H*. To follow the drawing and produce the different curves and fillets it would have been necessary to build up several courses of segments, prepare a wooden face plate and then turn the job in the lathe. It is apparent that had one complete ring been turned and then cut in two to provide a half ring at each end of the pattern, it still would have been necessary to do a considerable amount of hand work on account of the peculiar shape of the ends which project above the center line, *I*, Fig. 1.

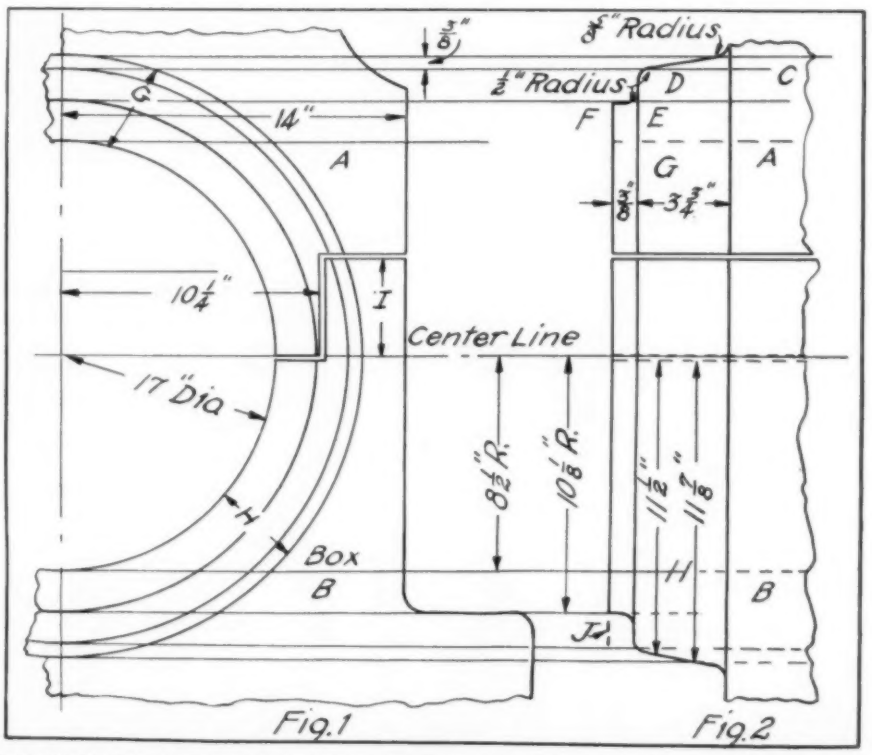
It was decided that the box would serve its purpose equally well without either curves or fillets and therefore the lathe was not employed in the construction of the pattern. The two end half rings, including the part projecting above the center line, were built up in segment courses and securely fastened with nails. They then were cut on the band saw, both straight and tapering, exactly to the finish lines. The pattern when finished appeared as shown at *J* Fig. 2. The object was not to perpetuate beauty of design but to effect a repair job in the shortest possible time.

Plain Drawings Needed For Pattern Shop

The drawing shown in the accompanying illustration is a typical example of those handed to the patternmaker every day. The draftsman is not familiar either with pattern shop or foundry practice and therefore the drawing is made showing the position the casting occupies in the general assembly. The piece is a cast iron ring 7 feet diameter by 1¼ inch thick, cast in two halves and bolted together as shown.

The bolting flanges, the straight ribs, also the outer flange and the inner ring are all on the under side of the flat circular plate *B* in other words the piece is shown exactly in the opposite position to that in which the patternmaker would build it. Due to the peculiar design, it is apparent that every rib that points to the right on the drawing will have to point to the left on the pattern during the course of construction, a condition which tends to confuse the patternmaker and cause errors.

To do this job properly, the piece should be re-drawn the other side up, but in many shops this is not permitted on account of taking so much time and the natural feeling in the mind of the foreman that one drawing



BY IGNORING THE CURVES AND FILLETS A LATHE JOB WAS CONVERTED INTO A JOB WITHIN THE CAPACITY OF THE BAND SAW

should be sufficient for all practical purposes. The ordinary patternmaker making a job like that shown in the illustration would make the flat ring *B* first and then build the ribs, rings, and flanges on top of it and in this case would find himself building a left hand pattern from a right hand drawing. This is one of the most prolific causes of mistakes in the pattern shop.

Keeping Track of Costs in Cleaning Room

By J. O. Proctor

Daily report cards on printed forms, or ruled in pencil, similar to the one shown in the accompanying illustration, are of interest to a cleaning room foreman. They show him where he stands constantly and help him to see his problems more clearly so that he may plan his work to produce the maximum tonnage at the minimum cost. Also by a comparison of sheets from day to day he readily can detect mistakes and errors of judgment and take the necessary steps to prevent repetition.

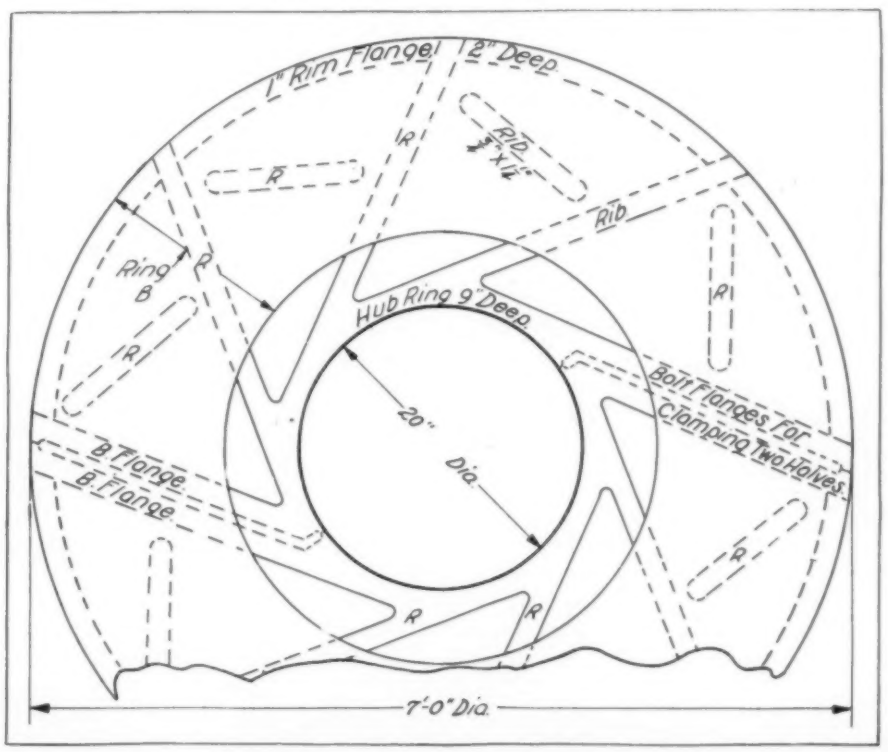
Each morning the hourly or daily column is filled in from information contained on the cards turned in by the men on the preceding evening. The foreman has the day workers' rates in his desk and the amount earned by the piece workers is secured from the shipper who also furnishes the data on the number of tons cleaned and shipped out on the preceding day. The pro rata amount of the general foreman's salary may be added and also the pro rata amount charged to maintenance and overhead, but as these latter items are constant, they really add nothing to the value of the sheet, which is designed simply as a medium for comparing the operating costs from day to day. The sheet is signed by the cleaning room foreman and turned into the foundry office where the different items are properly allocated according to the general cost system in vogue in the plant.

Form for Keeping Comparative Daily Costs

Foreman Date

Assistant foreman	1	$ 5.00
Clerk on chipping floor	1	5.00
Shipping clerk	1	5.00
Assistant shipper	1	4.50
Craneman	1	3.50
Chainman	1	3.25
Welder	1	5.00
Welder's helper	1	4.50
Burn-off men	1	4.50
Burn-off men's helper	1	4.00
Machine and saw men	1	3.50
Annealing man	1	3.00
Laborers	1	2.50
Blacksmith	1	6.00
Blacksmith's helper	1	4.50
Sand blast men	1	7.00
Sand blast men's helper	1	5.00
Chippers (piece work)	10	70.00
Grinders (piece work)	10	70.00
Chippers (day work)	3	12.00
Grinders (day work)	2	12.00
Total number men	42	
Total wages		$239.75
Total tons		80
Cost per ton		$299.00
Extra costs		None

Foreman



THE UNDER SIDE OF THE DRAWING WOULD BE TURNED UP DURING THE CONSTRUCTION OF THE PATTERN THUS INCREASING THE CHANCES OF ERROR IN LOCATING THE DIFFERENT RIBS AND FLANGES

Exhibition Space Taken

Success of the American Foundrymen's association exhibition to be held in Cleveland from Saturday April 28 to Thursday, May 3, is indicated by the large number of applications for space at the exhibit.

Application blanks for space were given to exhibitors on Monday, Jan. 15, and on Wednesday, Feb. 15, requests for space equalling the total amount of space available in the Cleveland auditorium, were filed with the manager of exhibits. Increased activity on the part of foundries generally in the purchase of foundry equipment, splendid facilities for exhibiting, and prospects of a record attendance of buyers at the Cleveland convention, account for the heavy demand for space

Railroad Rates Reduced

Each member of the American Foundrymen's association will receive in ample time before the Cleveland convention an identification certificate entitling the holder to a round trip rate or one and one-half times the regular one way fare. Additional certificates will be furnished for extra representatives of member firms.

One of the conditions of granting the special rate is that the certificates must be issued by the secretary of the association. They cannot be secured from the local ticket agent.

The advantage of the identification certificate plan over that of the validating ticket plan is that the purchaser is guaranteed the reduced rate regardless of how many tickets are used and does not require surrender and validation of the ticket at point of destination.

THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI.....504 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND.2-3 Caxton House, Westminster, S.W. 1
PARIS, FRANCE.....23 Rue de la Bienfaisance VIIIe
Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents
Copies published three months or more previous to date of current issue, 50 cents each.

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulations, Associated Business Papers, Inc., and National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1923 by The Penton Publishing Co.

Contents

	Page
Aluminum for Vacuum Sweepers	209
Research Group Extends Its Activities	215
Buys Stove Concern	215
Takes Preliminary Analysis	216
Equipment Employed for Making Soil Pipe	217
Operating Wilson Foundry—I	218
Standardizing Taper on Round Cores	225
Valve Castings Porous	226
Compositions for Gears	226
Box End Castings Should Be Made of Steel	226
Galvanizing Iron Castings	226
Limit Steel Percentage in Malleable Iron	226
Builds New Induction Furnace	227
How and Why in Brass Founding	229
Alloy of Nickel Bronze Melted in Cupola	229
High Temperature Causes Aluminum Trouble	229
Small Amount Aluminum Causes Pitting	229
Metal Is Poured Too Cold in a Dirty Mold	230
Scrap Aluminum Presents Melting Hazard	230
Leaded Alloys Not Always Acid Resisting	230
White Metal Alloy Will Resist Oxidation	230
Foundry Problems Discussed	231
Fine Sand Suitable if Properly Vented	232
Plan Two Day Meeting	232
Bill Makes Column Bases in Green Sand—II	233
Repairs Do Not Conform to Blueprints	236
Plain Drawings Needed for Pattern Shop	236
Keep Track of Costs in Cleaning Room	237
Exhibition Space Taken	237
Railroad Rates Reduced	237
Contents	238
Permanent Molds a Live Problem	238
Trade Outlook in the Foundry Industry	239
Comings and Goings of Foundrymen	240
Sales of Steel Castings Show Increase	241
Will Rebuild Promptly	241
Hold Session of British Institute of Metals	241
Adopt Method for Testing Molding Sand	241
Plan Itineraries to Paris Convention	241
Obituary	242
Belt Sander and Grinder Is Motor Driven	242
Installs Electric Furnace to Bake Enamel	242
Dust Proof Housing for Electric Motor	243
New Paris Office	243
Clothing Protection for Sandblast Men	244
Pouring Device Operated by Single Person	244
Acquires Machine Company	244
Develops New Binder	244
Slight Recession in Sales	245
What the Foundries are Doing	246

Permanent Molds a Live Problem

CAREFULLY making a sand mold which is destroyed by the metal poured into it seems like an inefficient operation and much effort has been expended in endeavoring to secure a permanent mold. The thorough experiments of Custer, although they failed in evolving a commercially practical process of casting in a permanent mold, have become classic. Through this research Custer secured valuable information regarding the effects produced in casting iron in iron molds, as well as the effect of the hot metal on the mold. Since these first extended experiments with permanent iron molds considerable work has been done along the same direction by a wide number of those seeking to overcome the many obstacles. However, most of those who have worked on permanent molds after Custer have, unlike him, failed to give the industry the benefits of their work. One thing has developed generally and that is that a lighter section than used by Custer has been found advantageous.

A process of casting individual piston rings of the larger sizes centrifugally in sand molds was described in THE FOUNDRY of Feb. 15, 1920. The idea in the use of sand molds was to prevent chill such as is developed when the castings are made in iron molds. However, a process for centrifugally cast piston ring pots in permanent molds was developed in England about the same time and is described in THE FOUNDRY of March 15, 1920. Later the process of casting pipe centrifugally in permanent molds was developed and two processes for this operation were patented. No doubt the information regarding permanent molds which was published by Custer many years ago when he cast pipe in permanent molds with a cast-iron core, was of assistance to the inventors of the centrifugal process.

In the one of these processes the metal is carried into the mold by a long trough. At the beginning of the operation, the metal flows along the trough and over a lip at the side into the far end of the mold which forms the bell of the pipe. The mold, revolving at the rate of 500 revolutions per minute, is moved away at a determined speed. Thus at the end of the pouring operation the mold has been withdrawn away from the spout. The bell end then is opened and gripped firmly, while the mold is returned to starting position thus drawing the pipe from the mold.

At times the metal first poured is cooler than the spigot end when the casting is dumped from the mold and a chill is noted over the entire length. This means that the casting must be annealed before it can be used. In another process endeavor is made to get around this feature by putting in the trough all of the metal to be poured into the mold, then introducing the trough into the center of the revolving mold and dumping the metal over the entire side instead of out the end. This spreads the metal along the full length of the mold and it all sets approximately simultaneously. In this method it is necessary to revolve the mold at a higher speed than in the first one described. However, this method is open to the objection that it chills the iron against the iron mold. Now this objection could be obviated by casting the metal in a mold lined with some non-chilling material.

Trade Outlook in the Foundry Industry

WHILE no spectacular boom is in progress in the foundry industry, a steady improvement is noted in the demand for all classes of castings. Consumers evidence a lively interest and inquiries are large and substantially backed by orders. Two features, only, occasion concern to foundry operators. The first and most pressing is the question of labor supply. Men are scarce and as the season advances and with the inroads of constructional demand, the shortage will become more acute. The second factor is the question of prices for castings.

Advances Expected

No doubt exists but that prices for castings must be raised. Raw materials are costing more each time renewal contracts are placed. Pig iron shows more strength with the advancing spring. Fuel costs are maintaining about the same level; but wages seem likely to be much higher. Despite these conditions, but little advance is noted in the prices asked for castings. Steel and malleable castings are slightly higher, and cast-iron pipe, radiators and stove castings have increased, but jobbing castings have not yet swung into line. In northern Ohio some machine castings in the medium heavy class have been contracted in the past few weeks at as low as 3¾ cents a pound. Jobbing steel castings likewise have not been increased. A case is cited of a foundry making a small but rather difficult casting in gray iron which was sold to the customer at 10 cents a pound. The customer desiring a few made in steel, the job was handled through the gray iron foundry and a price of only 11 cents a pound was asked by the steel foundry that made them. This price was so evidently out of line that it was advanced by the gray iron shop to 18 cents to the customer to avoid unfavorable comparisons.

Prices of Raw Material for Foundry Use

CORRECTED TO MARCH 8.

Iron		Scrap	
No. 2 Foundry, Valley	$27.00 to 28.00	Heavy melting steel, valley	$25.00 to 26.00
No. 2 Southern, Birmingham	26.00 to 27.00	Heavy melting steel, Pitts.	24.00 to 24.50
No. 2 Foundry, Chicago	30.00 to 31.00	Heavy melting steel, Chicago	22.00 to 23.00
No. 2 Foundry, Philadelphia	29.51 to 30.13	Stove plate, Chicago	24.75 to 25.50
No. 2 Foundry, Buffalo	28.50 to 29.50	No. 1 cast, Chicago	28.50 to 29.00
Basic, Valley	29.00 to 30.00	No. 1 cast, Philadelphia	26.00 to 27.00
Basic, Buffalo	28.00	No. 1 cast, Birmingham	22.00 to 23.00
Malleable, Chicago	30.00 to 31.00	No. 1 cast, Buffalo	26.00 to 27.00
Malleable, Buffalo	29.00 to 29.50	Car wheels, iron, Pittsburgh	26.00 to 26.50
Coke		Car wheels, iron, Chicago	27.50 to 28.00
		Railroad malleable, Chicago	27.50 to 28.00
Connellsville foundry, coke	$8.00 to 8.50	Agricultural mal., Chicago	27.50 to 28.00
Wise county foundry, coke	8.50 to 9.50	Malleable, Buffalo	25.00 to 26.00

Pig Iron Gains

Although the total of pig iron produced during February was slightly lower, the loss is due solely to the shorter month, as the daily output maintained the steady rate of gain noted during the past few months. The total recorded for February, according to statistics compiled by the *Iron Trade Review* was 2,989,819 tons, while January showed 3,228,226 tons. The average daily production was 106,779 tons per day for February, compared to 104,136 tons for the previous month. Merchant pig iron production in February was 704,706 tons as compared to the January total of 713,186 tons. On a daily average basis, February showed an output of 25,168 tons per day which is a gain of 2162 tons per day over the previous month. The total number of blast furnaces active on Feb. 28 was 278 which is an increase of 17 furnaces over the January closing count of 261. During the past month five merchant stacks were blown in and none was blown out. Prices for pig iron are slightly stronger and large contracts are noted for second quarter delivery. Pipe foundries have been heavy buyers, but little iron has been sold beyond the middle of the year. Prices for sand are higher and a scarcity is reported in some parts of the east.

Many Lines Active

Machine tool sales have been much improved since the first of the year, railway and automotive shop buying comprising the bulk of the demand. In consequence, considerable jobbing work is accruing to foundries from this source. Steel castings sales are increasing. According to the department of commerce, reports from the Steel Founders' Society, comprising over two-thirds of the steel castings capacity show sales in January to be the largest since March, 1920. The total reported is 103,161 tons, or at the rate of 107.2 per cent of capacity as compared with 71.1 per cent for December. Automobile production is still maintaining its usual stride. The schedules of the larger plants during the first two months of the year are 10 to 20 per cent higher than during the same period last year. Indications point to a larger output of cars in March than in the corresponding month last year. Railway orders continue in fair volume. Stove and radiator foundries are working at as high a rate as the available supply of labor will permit. One stove and range manufacturer reports sales of January as 300 per cent ahead of the first month of 1922. The demand for hardware, building sundries and small tools is exceptional, while implement and tractor plants note heavy seasonal requirements. A builder of heavy power machinery in the Pittsburgh district reports orders for steam turbine generators during the past few months aggregating 600,000 kilowatts capacity.

Nonferrous Prices

Prices for nonferrous castings, based on New York quotations in the *Daily Metal Trade* on March 8, follow: Casting copper, 16.50c; electrolytic copper, 17.00c; Straits tin, 47.12½c; lead, 8.50c to 8.60c; antimony, 9.00c; aluminum, No. 12 alloy, open market, 23.00c. Zinc is 7.80c to 7.85c, E. St. Louis, Ill. The average month prices for nonferrous metals during February, follow:

(New York Quotations)

Casting Copper	Electro Copper	Lead	Tin Straits	Antimony	Aluminum 98-99	Zinc St. Louis
15.15	15.62	8.177	42.00	7.208	23.52	7.266

Comings and Goings of Foundrymen

EDWARD PAYSON MATHEWSON, newly elected president of the American Institute of Mining and Metallurgical Engineers was accorded this honor in the light of his many years of brilliant achievement in the field of mining and metallurgy. His contributions to the art of smelting have been recognized throughout the world. In 1911, he was presented with the gold medal of the Institute of Mining and Metallurgy of London, and in 1917, the medal of the Mining and Metallurgical Society of America. He has also had bestowed upon him by the Japanese government the Third Order of the Rising Sun, and is the only honorary member of the Japanese Mining Industry association, of Tokio. In 1920 he received the honorary degree of doctor of science from the Colorado School of Mines and in 1921 the honorary degree of doctor of laws from McGill university, his alma mater. Dr. Mathewson, who is a consulting engineer with headquarters in New York, has previously served two terms as director of the American Institute of Mining and Metallurgical Engineers and has been chairman of both the Montana and New York local sections. He also has been a member of the council of the Canadian Institute of Mining and Metallurgy and of the Institution of Mining and Metallurgy. He is the author of a large number of technical papers and jointly with Ross E. Douglass, recently published a translation of Padre Barba's book "El Arte de Los Metales."

Charles Piez of the Link-Belt Co., Chicago, has been elected a director of the Walworth Mfg. Co., Boston, succeeding Richard F. Hoyt, resigned.

Henry T. Maxwell, one of the founders of and formerly treasurer of the Millbury Steel Foundry Co., Millbury, Mass., has been appointed postmaster of that town.

I. D. Adams, agent for foundry equipment and supplies, Syracuse, N. Y., has opened a branch office at 514 Brisbane building, Buffalo, in charge of A. S. Kenyon.

Patrick Dwyer, engineering editor, THE FOUNDRY, Cleveland, addressed the Pittsburgh Advertising club at its weekly meeting at the Hotel Chatham, Tuesday, March 6.

Robert R. Snow, formerly foundry superintendent for the Detroit Foundry Co., Detroit, now is connected with the D. J. Ryan Foundry Co., Ecorse, Mich.

Harry McCullion has been appointed general foreman of the foundry department of the Walker-Pratt Mfg. Co., Watertown, Mass. He was formally with the Scranton Stove Works at Scranton, Pa. M. E. Ward has been appointed assistant.

George Kuntz, formerly in charge of the Wright Mfg. Co., Lisbon, Ohio, has taken charge of the Hess-Snyder Co., Massillon.

William G. Roedersheimer has been promoted to foreman of the Auto Stove Works, New Athens, Ill.

John R. Schlagetter has accepted a foremanship with the Sidney Grain Machinery Co., Sidney, O.

J. H. Messenger, formerly of Jackson & Church Co., Saginaw, Mich., has been appointed foreman over the green sand molding floors at the Farrell Foundry & Machine Co., Ansonia, Conn.

D. J. McAvoy, formerly general foundry foreman of the Bunting Brass & Bronze Co., Toledo, O., has accepted position of general superintendent of the Bryan Pattern & Machine Co., Bryan, O., and will be in direct charge of the foundry and pattern departments.

William J. Muhlitner, formerly secretary and manager of the Foundry & Machine Products Co., Detroit, has been made secretary and general manager of the Great Lakes Distributing Co., miner and shipper of foundry sand and other supplies.

Edwin L. Andrew has been appointed assistant to manager of the department of publicity of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He was born in Washington county, Pennsylvania, and moved in 1907 to Tacoma, Wash., where he had preparatory schooling at the Stadium high school. He was graduated from the University of Wisconsin in 1916, after which he entered the employ of the Westinghouse company at East Pittsburgh on the apprenticeship course. He has served at the main works and also at the Cincinnati office.

Joseph Carter, formerly in charge of the electric furnace at Gerlinger Steel Casting Co., West Allis, Wis., has returned to the Northwestern Steel & Iron Corp., Minneapolis, to take charge of the open-hearth department.

Elbridge Walker, general sales agent of the Thomas Iron Co., has established his office in the Baer building, Read-

ing, Pa., where the headquarters of the Reading Iron Co. which recently acquired the Thomas properties, are located.

Roy F. Godfrey, formerly of Galion, O., has accepted a foremanship with the Weight Mfg. Co., Lisbon, O.

Frederic W. Howe, vice president and manager of the Crompton & Knowles Loom Works, Providence, R. I., is a director of the reorganized American Wringer Co., Woonsocket, R. I.

G. E. Croak has been appointed superintendent of the Davis-Farnum Mfg. Co., Waltham, Mass. The company operates an iron foundry, machine shop and pattern shop.

J. L. Simmon, formerly general manager of the Union Malleable Iron Co., East Moline, Ill., has been appointed general manager of the Canton, O., plant of the Dayton Malleable Iron Co., Dayton, O.

Frederick L. Harten, secretary and assistant treasurer of the Bay View Foundry Co., Sandusky, O., has disposed of his interest in the company to A. J. Wentworth of Cincinnati, who is vice president of the company. Mr. Harten's future plans have not been announced.

C. W. Pearson, who has been associated with the Buffalo Foundry & Machine Co., Buffalo, in various managerial positions for a number of years, and for the past year in charge of sales, has been elected vice president and treasurer of the company. In addition to his new duties, he will continue as director of sales. P. J. Krentz, who for a number of years has been works manager for the company, has been elected a vice president. As in the past, he will continue actively in charge of manufacture and production. Both Mr. Pearson and Mr. Krentz have been with the Buffalo company practically since its organization.

Sales of Steel Castings Show Increase

Sales of commercial steel castings in January were the largest since March, 1920, according to reports received by the department of commerce through the bureau of the census, in co-operation with the Steel Founders' society, from companies comprising over two-thirds of the commercial-castings capacity of the United States.

Total bookings reported in January were 103,161 tons by firms with a capacity normally devoted to commercial castings of 96,200 tons, or at the rate of 107.2 per cent of capacity, as against December bookings at 71.1 per cent of capacity. Bookings of railway specialties amounted to 47,879 tons, or 125 per cent of capacity, as against 73.8 per cent for December bookings. Bookings of miscellaneous castings amounted to 55,282 tons, or 94.3 per cent of capacity, and the largest amount booked in any month since records are available, in January, 1920.

Will Rebuild Promptly

Erection of a new foundry building, 132 x 60 feet, to replace the shop burnt down Feb. 2, was begun Feb. 23, by S. C. McLouth, Marine City, Mich. The new building will be the same length and twice the width of the one destroyed, a capacity of about 20 tons daily being anticipated on its completion, which is expected to be in about three weeks.

The firm has about six months work ahead at maximum capacity, and was able to save most of the machines and metallic equipment, but the majority of the wooden patterns and coreboxes were lost.

Hold Session of British Institute of Metals

An unusual number of papers were presented at the annual meeting of the British Institute of Metals which was held in London March 7 and 8. There were two sessions on each day, the annual dinner being held Wednesday evening, March 7.

Among the papers which were presented are the following: "Further Studies in Season Cracking and Its Prevention—The Removal of Internal Stress in 60-40 Brass," by S. Beckinsale; "The Constitution of Some Alloys of Aluminum with Copper and Nickel," by Miss K. Bingham and J. L. Haughton; "The Heat Treatment and Mechanical Properties of Alloys of Aluminum with Small Percentages of Copper," by D. Hanson and Miss M. L. V. Gaylor; "The Density and the Hardness of the Cast Alloys of Copper With Tin," by Harold Heape; "The Production and Heat Treatment of Chill Castings in an Aluminum Alloy Y," by Dr. Walter Rosenhain and S. A. E. Wells, of the National Physical laboratory, London, and S. L. Archbutt.

Adopt Method for Testing Molding Sand

At the regular monthly meeting of the Quad City Foundrymen's association, held in Rock Island, Ill., Monday, Feb. 19, reports were presented by individual members who had tried, the method of testing sand outlined by Eugene Smith at the January meeting of the association. The consensus of opinion was that the method is of practical value and a number of the members said they intend to make this method standard practice in their foundries.

J. E. Nyhan, secretary of the Moline Y. M. C. A. spoke on the relationship which should exist between the workmen and the management.

A nominating committee, consisting of William Seiffert, Moline Plow Co., chairman; H. Bornstein, Deere & Co.; and Fred Zimmerman, Zimmerman Steel Co., was appointed to make nominations of officers for the ensuing year.

An invitation was received from the local section of the American Society for Steel Treating for the foundrymen to be present at the steel treaters' February meeting, at which Paul D. Merica, director of research, International Nickel Co., New York, was to speak on the metallurgy and uses of nickel.

Plan Itineraries to Paris Convention

In response to the invitation received from the Association Technique de Fonderie of France, to visit the International Foundrymen's convention and exhibition in Paris, and subsequent invitations from the Foundrymen's association of Belgium and from the Institution of British Foundrymen, the committee on international relations of the American Foundrymen's association has arranged three proposed itineraries. One covers 17 days in England, leaving New York Saturday, Aug. 18 and arriving Saturday, Aug. 25 for a reception in London by the London branch of the Institution of British Foundrymen. After inspecting plants in London the party will visit foundries and manufacturing plants in Sheffield, Manchester, Birmingham, and Coventry. Besides the plant visitation, trips will be made to a number of historically interesting sections. The party will leave for Paris Tuesday, Sept. 11. The estimated cost of this itinerary is $143.50, exclusive of ocean passage. Minimum ocean passage on steamers sailing in conjunction with the dates given will be from $260 to $275 one way.

A second itinerary, including 10 days in England, proposes leaving New York Saturday, Aug. 25, with a reception by the Institution of British Foundrymen in London, Saturday, Sept. 1. This itinerary covers a visit to all the cities included in the first itinerary, but the stops will be shorter. The estimated cost of first class travel is $103, exclusive of ocean passage.

The continental tour will leave London for Paris Tuesday, Sept. 11, spending the following week at the convention. The party will leave Paris Tuesday evening, Sept. 18, visiting the Nancy district, from where the visitors will motor via Mousson, St. Mihiel and Verdon to Metz. Then

from Metz the party goes to Liege, Brussels and Lille before returning to Paris, Tuesday, Sept. 25. Transportation from London to Paris and second class accommodations on the continent is estimated to cost $106.

H. Cole Estep, London, England, is chairman of the committee on international relations, Stanley E. Flagg Jr., is vice president and C. E. Hoyt, secretary of the association, Marquette building, Chicago, is also secretary of the committee. Other members of the committee are L. L. Anthes, Anthes Foundry Ltd., Toronto, Canada; A. O. Backert, Penton Publishing Co., Cleveland; G. H. Clamer Ajax Metal Co., Philadelphia; and Franklin G. Smith, Osborn Mfg. Co., Cleveland.

Obituary

George A. Draper, treasurer of the Draper Corp., Hopedale, Mass., manufacturers of textile machines, died at the Massachusetts general hospital, Boston, Feb. 8. Mr. Draper had been associated with the Draper Corp. since 1855.

Howard M. Wilson, aged 60, president and director of the Taylor-Wilson Mfg. Co., McKees Rocks, Pa., builder of tube and rolling mill machinery, died suddenly in his office Friday, Feb. 16. Mr. Wilson was one of the founders of the Taylor-Wilson company, which was organized in 1893, and for the last 10 years had been president. He was born in Pittsburgh and was one of the founders and charter members of the Pittsburgh Foundrymen's association; was a member of the Pittsburgh chamber of commerce and various other organizations.

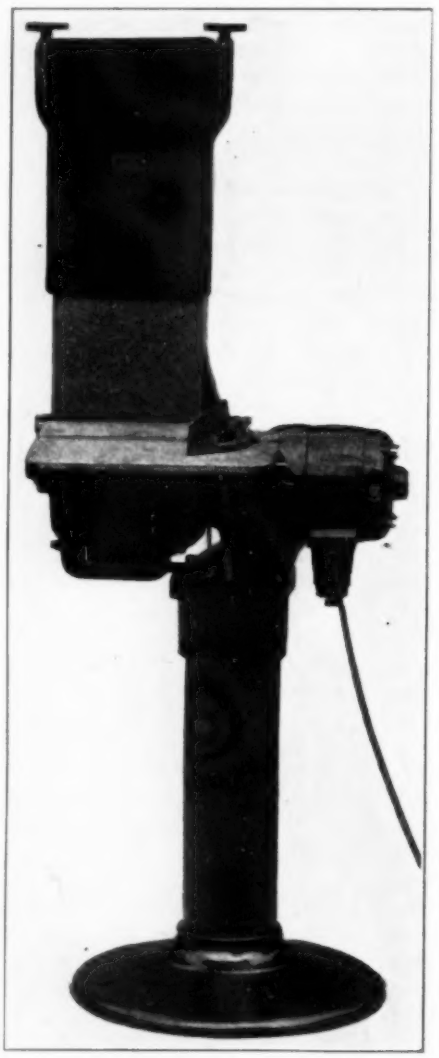
Daniel W. Tower, aged 75 years, who established the first brass foundry in Grand Rapids, Mich., in 1882, which was the nucleus of what is now the Grand Rapids Brass Co., died at his home in that city, recently. He was nationally known as a traveler and lecturer.

Mark W. Ray, vice president of the Lava Crucible Co. of Pittsburgh, died Feb. 4 in his home in that city. He was born at Indiana, Pa., and came to Pittsburgh 30 years ago to become a member of the firm of Ray, Weller & Co., public accountants, of which he was one of the organizers.

Robert L. Janney, consulting engineer for the American Steel Foundries, Chicago, died March 2 at St. Lukes hospital, Chicago, after an illness of considerable length. He was the inventor and developer of numerous railroad appliances, some of which bear his name.

Belt Sander and Grinder Is Motor Driven

Manufacturers of finished and polished parts that require straight grain finish and sharp edges and who appreciate the economy of motor driven machinery may be interested in the belt sander and grinder shown in the accompanying illustration. It is made by the Porter-Cable Machine Co., Syracuse, N. Y., which recently has taken over the business of the Syracuse Sander Mfg., Co. In addition to its use in the pattern shop and furniture factory it is claimed that it is adapted for use in the manufacture of instruments, metal parts, stampings, castings and in grinding and finishing of aluminum, bakolite, bone, brass, celluloid, copper, fibre, horn, steel and porcelain.



GRINDING BED MAY BE SET EITHER HORIZONTALLY OR VERTICALLY

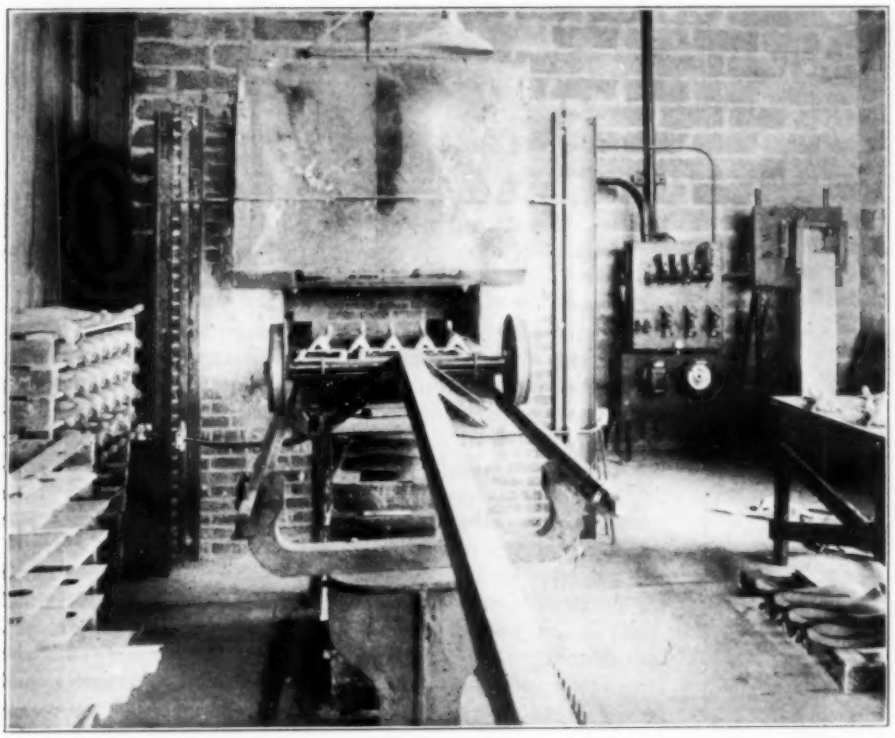
The grinding bed may be set at any angle from horizontal to vertical and the table may be tilted by a hand wheel to any point between 45 degrees down and 15 degrees up. The table may be removed when it is necessary to use the grinding bed in a horizontal position. It is replaced by a stop rod which acts as a guide in grinding or sanding small pieces. The angle gage and core print gage operate in a slot in the table and may be set to any angle right or left up to 45 degrees. The ball bearing General Electric motor is totally enclosed and protected from flying dirt and grit. Adjusting screws insure the positive parallel running of the belt and also are used in securing the required tension or while changing belts. The abrasive belt 10 x 64½ inches may be changed at any time. It is stated that these belts are made especially for the machine. A leather belt may be substituted for buffing and polishing.

Installs Electric Furnace To Bake Enamel

A new electric furnace used to bake vitreous enamel on cast iron stove parts and on sheet steel has been installed recently by the Galusha Stove Co., Rochester, N. Y. The furnace operates at from 1200 to 1400 degrees Fahr., with a maximum temperature range of 2000 degrees, and has a connected load of 118 kilowatts at 230 volts, 3 phase and 60 cycles. The capacity is estimated at 7 pounds of metal per kilowatt hour.

The equipment, as shown in the accompanying illustration, consists of the furnace proper and the automatic control panel and instruments. The furnace is constructed of brick with refractory lining, having a sliding door giving access to the upper compartment from the front. The interior is divided horizontally into two compartments by narrow shelves on each side wall which support the tray holding the work to be baked. The nickel chromium heat units are mounted away from the side walls, and are about evenly distributed between the upper and lower compartments. This arrangement together with the curved roof tends to cause the heat to strike the work equally from all directions. The temperature is automatically controlled by an automatic temperature control instrument and an automatic control panel carrying contactors and overload relays.

Two temperature settings and baking durations are required for the two types of material. The company operating the furnace buys the power from a central station on what is known as the three rate schedule, whereby power used at a steady rate for 24 hours a day can be purchased at the lowest rate. A schedule has



ELECTRIC ENAMELING FURNACE HAVING AUTOMATIC HEAT CONTROL INSTRUMENTS

been worked out for the operation of these furnaces so that its running periods are dovetailed with the other power using devices of the plant, with the result that no additional demand is created during the daytime. By not running the furnace during peak loads in the winter months further economy has been effected in the operating costs. The economy that has resulted from the use of this furnace is due, in addition to the factors already mentioned, to the speed with which the material is finished, the reduced attendance necessary, and to the perfection of the finished product.

Dust Proof Housing for Electric Motor

J. Carlton Ward Jr.

One of the dust-proof hoods placed over the motors in the plant of the Pratt & Whitney Co., Hartford, Conn., is shown in the accompanying illustration. The reproduction may not appear clearly, but the motor frame was quite clean when the hood was removed. This particular installation is directly back of a large sandblast device and prior to the adoption of the housing, sand drifted in large quantities over the motor frame. Under former conditions the life of the bushings averaged from 4 to 6 months. Since the hood was placed over the motor two years ago the bushings have not been changed.

The opening around the shaft between the motor and the pulley is carefully sealed to prevent fine dust from sifting through. A large door is provided at one side through which the motor may be inspected and occasionally cleaned with air hose. In certain locations it has been found advisable to ventilate the motors from outside by providing a nonventilating hood around the motor and leaving an aperture in the wall for the admission of cool air. This treatment in particular applied to instances where flying coal dust impregnated the windings and caused dangerous short circuits. It is claimed that the adoption of one or the other of these pieces of equipment has cured any trouble where it formerly existed.

Opens New Paris Office

To provide better facilities for handling its business in western Europe the Paris office of THE FOUNDRY has been moved from 224 Rue de Rivoli to 23 Rue de la Bienfaisance. The new location is only a short distance from the general offices of the Comité des Forges and other prominent French iron, steel and engineering interests. The telephone number at the new office is Wagram 3533 and the cable address is unchanged; Irotrapri, Paris.

Representatives of the American iron and steel fraternity are especially invited to make use of the facilities of our Paris office when in Europe. The office remains in charge of Vincent Delport, French correspondent, and under the general direction of the European headquarters of the Penton Publishing Co., in Caxton House, Westminster, London. The Penton Publishing Co. also publishes *Iron Trade Review, Daily Metal Trade, Abrasive Industry, Power Boating and Marine Review.*

The American Engineering Co. Philadelphia, has taken over the Standard Crane & Hoist Co., and the patent and manufacturing rights to the monorail electric hoist made by that company.

FIG. 1—A CLOTH SCREEN PREVENTS DUST FROM SETTLING ON THE MOTOR
FIG. 2—A SCREEN COVERED DOOR PERMITS READY ACCESS TO THE MOTOR

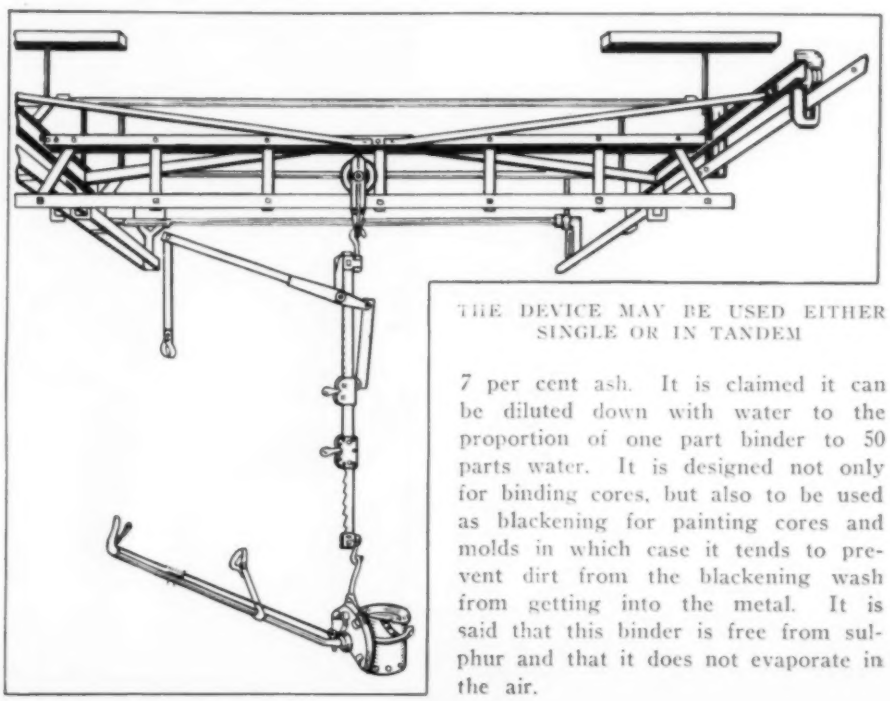
CHROME LEATHER FRONT ON THE HOOD AND APRON PRESENTS SUPERIOR WEARING QUALITY

Clothing Protection for Sandblast Men

To meet the need of clothing that will withstand the wear incident to the use of metallic abrasive, the Pangborn Corp., Hagerstown, Md., recently has developed and placed on the market the apron and hood shown in the accompanying illustration. The front of the apron is made of chrome leather. Spring clips are employed to bind it securely to the operator's legs in such a manner that it is not binding and may be put on or off easily and quickly. It is claimed that the chrome leather front and crown of the hood resist abrasion better than other fabrics that have been tried for the purpose. The hood is made with an adjustable band to fit any size head and is provided in front with a finely woven wire, extra heavy sight screen. It is stated that while this screen assures clear vision, it also protects the operator's eyes and may be replaced easily and cheaply.

Pouring Device Operated by Single Person

To facilitate the pouring of a great number of small molds the Chicago Molding Machine Co., 2028 North Major avenue, Chicago, has devised the equipment shown in the accompanying illustration, which it is claimed can be operated easily by one man. The operator stands in the same relative position as when pouring with an ordinary ladle. He is relieved of the weight of the ladle which holds the equivalent of several hand ladles and in addition it is stated that the control is so nicely balanced and positive that small sprues may be poured with the greatest accuracy. An automatic locking device holds the ladle in any position desired. A simple attachment is employed to lower and raise the ladle quickly to any limit within three feet. The hoisting device is suspended from a light steel traveling frame 12 feet in length mounted on a truck 6 feet long at each end. Each truck is supported on two 6-inch ball bearing wheels. It is claimed that this type of traveler is extremely sensitive and will follow the ladle easily and readiy. The track, ⅜ x 3-inch cold rolled steel, is mounted on edge on brackets spaced on 4-foot centers. The brackets are machined to insure a straight and level track and are suspended by ½-inch rods from the roof. The wheel housings are designed to embrace the track in such a manner that it is impossible for the trucks to jump the track or fall down. The device is furnished in four sizes to accommodate either a 100, 150, 200 or 250 pound ladle.



THE DEVICE MAY BE USED EITHER SINGLE OR IN TANDEM

Acquires Sander Machine Building Company

The Porter-Cable Machine Co., Syracuse, N. Y., manufacturer of tool-room and production lathes and vertical milling attachments recently purchased the business, equipment and good will of the Syracuse Sander Mfg. Co. The equipment of the Sander company has been moved to the Porter-Cable plant. The company will continue the manufacture of the Syracuse company's products which include portable motor driven disk and spindle sanders and 20-inch band saws. Extensive plans are under way for the development of sanding machinery and a motor-driven belt sander and a woodworkers' lathe have been added to the company's products.

The Western Malleable Co. of Beaver Dam, Wis., is building a core-room, 38 x 58 feet, to be used only by girls and women engaged in this work. At present about 20 girls are doing piece work alongside of men.

Develops New Binder

Beecraft & Partners, Ltd., metallurgical and foundry chemists, St. Peter's Close, Sheffield, have developed a core binder which is said to contain over 80 per cent gums and less than 7 per cent ash. It is claimed it can be diluted down with water to the proportion of one part binder to 50 parts water. It is designed not only for binding cores, but also to be used as blackening for painting cores and molds in which case it tends to prevent dirt from the blackening wash from getting into the metal. It is said that this binder is free from sulphur and that it does not evaporate in the air.

Note Slight Recession in Sales

Foundry Equipment Demand Is Lighter, Although Inquiry Continues Strong and Sales of Light Sundries and Supplies Indicate Latent Needs Which May Develop Later

ACTUAL demand for foundry equipment is slightly less intensive than during January and the early part of February, although inquiry continues fairly brisk. Foreign sales continue to improve. J. L. Nering Bogel & Co., Deventer, Holland, are interested in complete machinery for the manufacture of heating radiators. Molding machines in particular are desired. The Athens Plow Co., Athens, Tenn., plans to build a foundry this year and will desire complete equipment. R. J. Fisher is president and E. L. Wilson, secretary. The Alloy Electric Steel Castings Co., Youngstown, O., has started work on the erection of the first unit of its plant near Leavittsburgh, O. The Stockham Pipe & Fittings Co., Birmingham, Ala., is inquiring for light metal snap flasks to replace its present wood equipment.

Demand Continues in the East

TRADING in foundry equipment continues brisk. While as usual the bulk of buying is for replacement purposes, there is some good buying for new plants and other foundry construction. The Eastern Foundry Co., Boyertown, Pa., continues a substantial buyer for its new $200,000 plant, which it is understood will be devoted largely to the production of sanitary ware. The American Brake Shoe & Foundry Co., building two plants, one at Portsmouth, Va., and the other at Houston, Texas, also is an active buyer. Recent purchases include two tumbling barrels, a cupola, and several charging cars awarded the Whiting Corp., Harvey, Ill., for installation in its Portsmouth plant. The Millinocket Foundry & Machine Co., Millinocket, Me., has closed on a 5-ton handpower crane, 30-foot span, to the Whiting Corp., and the Frick Co., Waynesboro, Pa., on two 2-ton, 3-motor traveling cranes to the Hoist & Crane Engineering Co. The Utah Copper Co., with headquarters in New York city, has been a recent buyer of equipment for its Arthur Foundry, Arthur, Utah, including a 15-ton electric crane with 30-foot span, placed with the Whiting Corp. The New Jersey Foundry & Machine Co. has closed on two 1½-ton foundry-type, underbraced cranes with 18-foot radius, for a foundry in the Philadelphia district. Included in pending foundry projects is a branch plant for the Krupp Foundry Co., Lansdale, Pa., the initial unit of which will be 125 x 200 feet, 1-story high. Options have been taken on a 21-acre site at Quakertown, Pa. The Montgomery Foundry & Fittings Co., Conshohocken, Pa., noted some time ago as contemplating a new addition, now has completed plans which call for a building 135 feet x 290 feet long. Another project in contemplation for some time and now getting under way, is a $60,000 addition for the Waterbury Farrell Foundry & Machine Co., Waterbury, Conn. The Immick Co., Meriden, Conn., has just been awarded the general contract. The Thatcher Furnace Co., Newark, is reported to be contemplating the erection of a $50,000 plant addition. The National Car Wheel Co. is installing equipment at its Rochester, N. Y., plant for experimenting in the casting of car wheels by machinery. It is planned to get this experimentation under way early in April. Eastern Steel Castings, Newark, which has been a steady buyer of late, has recently closed on some sandblast machinery to the Pangborn Corp., Hagerstown, Md. It is now installing an electric furnace, the order for which was placed some time ago. The Pittsburgh Valve Foundry & Construction Co., Pittsburgh, is understood to be installing an electric furnace, and the Fort Pitt Malleable Iron Co., McKees Rocks, Pa., has or is about to close on a sand mixer. Prices, reflecting in particular the advance in steel, are showing an upward tendency. The Oriskany Malleable Iron Co., Oriskany, N. Y., has purchased a sand blast installation from the Pangborn Corp., Hagerstown, Md. The W. W. Sly Mfg. Co., Cleveland, recently has contracted for tumbling mills with dust arrester equipment with the Bartlett-Hayward Co., Baltimore, Md., and the same interest is installing two sand blast rooms, and a cinder mill. The Saco-Lowell Shops, Boston, is installing three sand blast mills and a rotary table type machine with a dust arrester furnished by the same manufacturer. Recently the Kennedy Valve Mfg. Co., Elmira, N. Y., the Portland Stove Co., Portland, Me., and the Boston Brass Co., Waltham, Mass., have contracted with the Sly company for tumbling and sand blast equipment.

Inquiries Brisk in Pittsburgh

INQUIRIES for foundry equipment still continue to be received in fair number in the Pittsburgh territory and several which have been out for some time still are held in abeyance. Orders since the first of the month have not been numerous except for the smaller supplies such as steel flasks, riddles, shovels, wheelbarrows, foundry facings, etc. Recent purchasers in this district of steel flasks from the Truscon Steel Co., Youngstown, O., include the Westinghouse Airbrake Co., the Union Switch & Signal Co., United States Sanitary Mfg. Co., Hempfield Foundries, Greensburg, Pa., and Metric Metal Works, Erie, Pa. Numerous foundries find their present molding machine equipment inadequate for the work in hand, or which they contemplate taking on; hence, they are about to close on additional units. The Ajax Iron Works, Corry, Pa., recently closed on a large rollover machine with the Herman Pneumatic Machine Co. E. H. Williams, Vulcan Mold & Iron Co., Latrobe, Pa., has purchased a cupola and probably will buy additional foundry equipment, machinery and supplies later. The Dishaw Foundry Co., Canton, N. Y., contemplates the installation of various kinds of additional equipment soon. Crane and hoist inquiries develop from time to time from foundries and several hoist orders recently have been taken by two or three of the prominent manufacturers represented here. The Oil Well Supply Co., Oil City, Pa., and the Kelly & Jones Co., Greensburg, Pa., each closed on a 5-ton crane with the Pawling & Harnischfeger Co., Milwaukee, Wis. The Standard Sanitary Mfg. Co., New Brighton, Pa., has purchased a mill for grinding enamel from the Hardinge Co., New York. The Duquesne Steel

Foundry Co., Coraopolis, Pa., has purchased tumbling mills and a dust arrester from the W. W. Sly Mfg. Co., Cleveland.

Tapering Off Noted in Chicago District

DEMAND for foundry equipment is distinctly less than during the past few months. February brought considerably less orders for equipment and supplies than previous months. Inasmuch as foundries are melting more iron than for a long time and pig iron and coke buying are heavy, it would seem that the present slack demand for equipment must be only temporary. The Millnocket Foundry & Machine Co. at Millnocket, Maine, has ordered a 5-ton hand power crane from the Whiting Corp., Harvey, Ill., which has also sold a 10-ton electric crane to the Lindgren Foundry Co., Batavia, Ill., a 24-inch special cupola to the Board of Education at Milwaukee, two 33 x 84-inch tumbling barrels to the Buick Motor Co., Flint, Mich., a 48-inch cupola to the Pacific Sanitary Co., Richmond, Calif., a 54-inch cupola to the Quality Foundry & Mfg. Co., Los Angeles, Calif., and a 72-inch cupola to the Anniston Foundry Co., Anniston, Ala. A number of projected new foundries and additions to present plants are being considered with engineers but are slow to come to the point of actual building. Recent purchasers of sand blast equipment from the Pangborn Corp., Hagerstown, Md., include the Wisconsin Malleable Iron Co., Milwaukee, the Packard Motor Car Co., Detroit, and the Crane Co. and the Illinois Malleable Iron Co., Chicago. The American Malleables Co., Owosso, Mich., and the Eureka Foundry Co., Chattanooga, Tenn., have purchased a dust arrester installation from the W. W. Sly Mfg. Co., Cleveland, the latter also taking a battery of tumbling mills from the same maker. Other sales of the Sly company include sand blast equipment for the Ford Motor Co., Detroit, the Terre Haute Malleable & Mfg. Co., Terre Haute, Ind., the Gartland-Haswell-Rentchler Co., Dayton, O., and the Cleveland Co-operative Stove Co., Cleveland. The Bridge & Beach Mfg. Co., St. Louis, recently has purchased water polishing mills from the W. W. Sly Mfg. Co., Cleveland.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

The foundry of the Chandler & Taylor Co., Indianapolis, recently was damaged by fire.

Construction of an addition to its plant is planned by the National Cast Iron Pipe Co., Birmingham, Ala.

Erection of an addition to its plant has been started by the National Brass & Aluminum Co., Dundas street, Toronto, Ont.

The Richmond Sanitary Mfg. Co., Oakland, Cal., plans the erection of a plant building to cost about $25,000.

The foundry of the Oshkosh Iron & Metal Co., Oshkosh, Wis., recently was damaged by fire. Nathan Levine is proprietor.

The Pocono Foundry Co., Bath, Pa., is understood to be planning the installation of additional equipment.

Part of the Warren Foundry & Machine Co., Phillipsburg, N. J., recently was damaged by fire.

The Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., plans to rebuild its foundry building which was damaged by fire recently.

The Krupp Foundry Co., Inc., Lansdale, Pa., plans the erection of a 1-story foundry unit, 125 x 200 feet, at Quakertown, Pa.

The capital stock of the Ross-Meehan Foundries, Chattanooga, Tenn., recently was increased from $60,000 to $1,260,000.

The Crescent Park Brass Foundry, Waltham, Mass., is reported considering the erection of a new plant.

The Royal Brass Co., 1430 East Third street, Cleveland, has obtained a permit to erect a 1-story factory addition to cost about $5000.

The Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., contemplates the construction of a gray iron foundry at Ensley, Ala.

The Austin Co., Cleveland, has broken ground for the erection of a plant building for the Ohio Stove Co., Portsmouth, O. It will be 30 x 100 feet.

The J. B. Ripley Brass Foundry Co., Inc., Windsor, Vt., has been incorporated with a capital stock of $10,000 by J. P. Ripley, A. M. Ripley and Edgar L. Bishop, of Waverly, Mass.

Erection of plant additions and the purchase of additional machinery and equipment is planned by the Badger Foundry Co., Racine, Wis.

Plans have been completed by the Montgomery Foundry & Fittings Co., Conshohocken, Pa., for the erection of a plant building, 135 x 290 feet.

The Dishaw Foundry Co., Canton, N. Y., is reported considering the installation of additional equipment. C. F. Dishaw is president of the company.

The Thatcher Furnace Co., 41 St. Francis street, Newark, N. J., plans the erection of a 2-story plant building addition, 34 x 84 feet. A 1-story structure, 50 x 122 feet, also will be erected.

The Dalton Malleable Casting Co., Warsaw, Ind., has been incorporated with a capital stock of $350,000 by Donald J. Dalton, T. C. Frazer, W. D. Frazer, J. S. Dalton and J. E. Readley.

The Brazil Machine & Foundry Co., Brazil, Ind., which is building a small plant building has not yet determined what its equipment requirements will be.

Capitalized at $250,000 the Agricola Pipe Co., Gadsden, Ala., has been incorporated by Otto Agricola, Fred T. Agricola and others. It succeeds the Campbell Co. and will engage in the manufacture of iron and soil pipe.

The Colonial Brass Works, Inc., New Britain, Conn., has been incorporated to operate a foundry with a capital stock of $50,000. It was incorporated by R. J. Carlson, A. G. Carlson, P. C. Carlson and others.

The Marshall Furnace Co., Marshall, Mich., plans to rebuild its plant which was damaged by fire recently. The building will be one story, 130 x 250 feet, and will cost about $50,000.

Capitalized at $100,000 the Atlas Die-Casting Corp., Worcester, Mass., has been formed to make die castings by Alexander B. Campbell, William J. Woods, Harry Smith, Phillips B. Bergstrom and Edwin G. Norman, all of Worcester.

The Samson Power Machine Co., 3300 Dill avenue, Richmond, Va., recently was incorporated with a capital stock of $50,000 to engage in the manufacture of stump pullers and other machinery. It plans to erect a plant including a malleable foundry and now is seeking estimates and bids on equipment for the latter. Officers of the company are: President, Irvin Bain; vice president, James D. Sheahan and secretary and treasurer, J. S. Bain.

The business of the La Crosse Motors Equipment Co., La Crosse, Wis., has been incorporated with $50,000 capital stock by J. Magio, R. Z. Chopiesky and W. A. Hinrichs. It will continue to specialize in casting and machining piston rings for gas engines.

The Alloy Electric Steel Castings Co., Youngstown, O., will start work soon on the erection of the first unit of its proposed plant near Leavittsburgh, O. The unit will be 118 x 280 feet and will have a capacity of 1000 tons a month.

A 2-story office building, 40 x 70 feet, will be erected by the Erie Foundry Co., Erie, Pa. Ground for the structure will be broken within 30 days. The company manufactures steam hammers, trimming presses, squaring shears, gray iron castings, etc. Officers are: President and treasurer, John R. McDonald; vice president, F. F. Clark; vice president and general manager, A. N. Bates, and secretary and assistant general manager, D. A. Currie.

While catering to general jobbing business, the newly organized Reliance Foundry Co., Schleisingerville, Wis., expects to make semi-steel as well as gray iron castings and will specialize in parts for diesel engines, pumping engines, compressed air, ammonia and automobile use and for rubber tire molds, gear blanks, die castings, etc. The company was formed under the direction of James H. Wilkins of Milwaukee, and is capitalized at $25,000.

The Columbiana Foundry Co., McKeesport, Pa., which has been in the hands of a receiver, has been purchased by McKeesport business men and the Columbiana Foundry Co., organized with $600,000 capital stock to operate the plant. Additional ground has been purchased and plans are under way for the erection of several buildings. The company will manufacture iron castings exclusively. Officers are: President, Dr. Thos. Nason; vice president, J. D. O'Neil, and secretary and treasurer, Robert C. Painter.